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INSTRUMENTS

INDUSTRIAL — SCIENTIFIC

Devoted to the Instrument Problems of all Industries

Vol. 2. No. 2 Pittsburgh, Pa. February, 1929

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Searching for Information on Instruments and Measurements.
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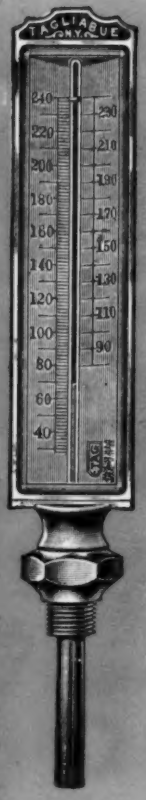

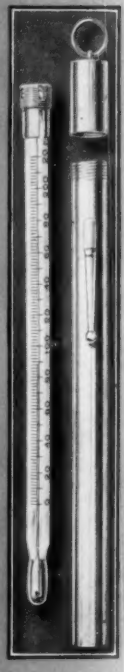

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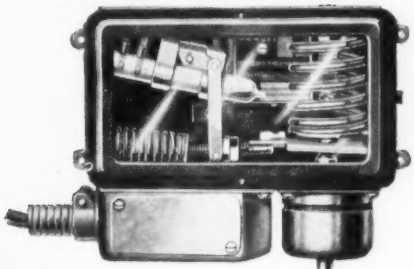

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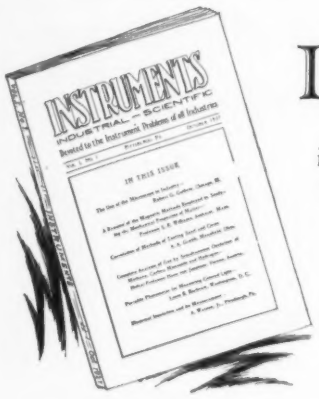

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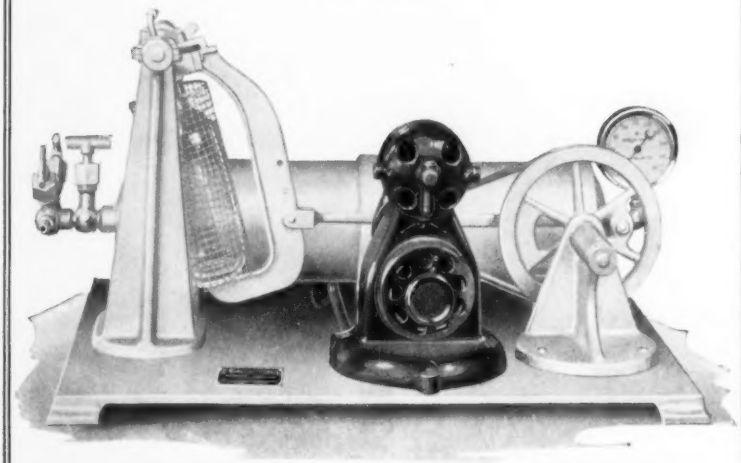

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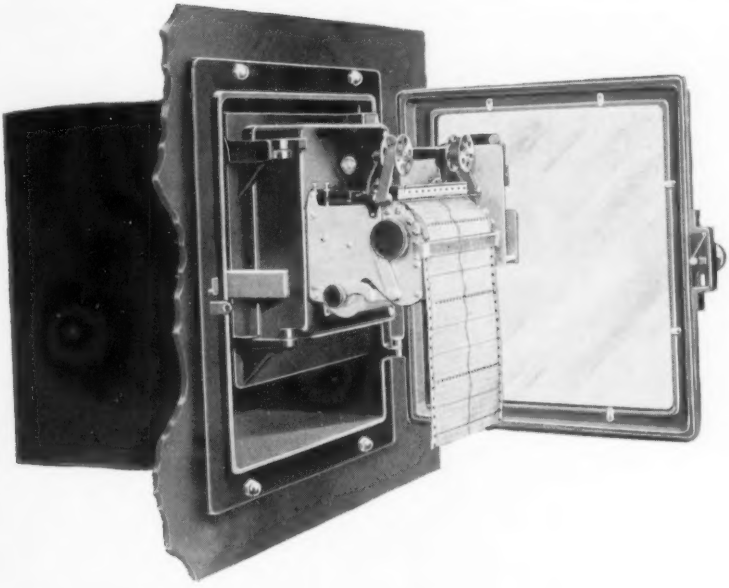

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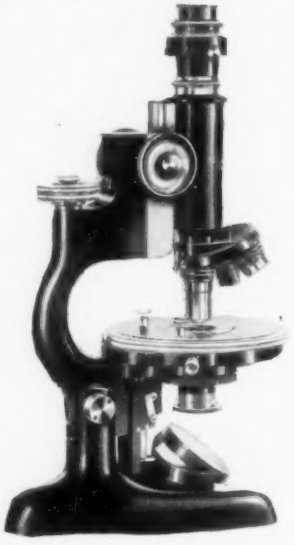

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Vol. 2 No. 2 **PITTSBURGH, PA.** **February, 1929**

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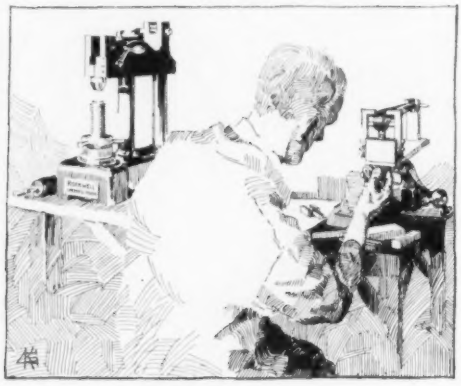
Have your stenographer cut out and mount the index found bound in the back of this issue, listing the principal articles. They will direct you to valuable information to which you may wish to refer in the future.



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Vol. 2, No. 2 FEBRUARY, 1929 Pittsburgh, Pa.

To Our Readers

THE editor last month asked the readers to assist him by offering suggestions, and he takes this opportunity to thank the large number, who were kind enough to send in their comments.

A number wrote in pointing out that the file cards as they had been previously bound in the book, did not conform to the sizes of cards used by them. To overcome this difficulty the File Card Section has been changed so that the references can be mounted on any card the reader now uses.

The editor has another request to make to the readers. Several cases, similar to the following, have come to our attention. An advertiser receives a large number of inquiries as a result of an announcement made in INSTRUMENTS but only about half state that they read the information in our journal.

Naturally the advertiser is influenced in his choice of an advertising medium by the number of inquiries he receives, and unless the periodical is mentioned, it is usually impossible to credit the proper medium.

You will therefore find the following line printed at the foot of each advertising page:

"When writing to the above companies, please mention INSTRUMENTS."

We hope you will comply with our request.

——— :: ———

Do Instruments Receive the Proper Consideration When Company Budgets Are Made?

COMPETITION is no longer between companies in the same industry—the new competition is between industries. In several instances it has reached the stage of open warfare. At present a tobacco company is openly battling the candy industry; and the candy industry, as an industry, has been forced to fight back. Electric refrigeration has compelled the ice manufacturers to band together and fight for their very existence.

The instrument companies feel this new competition. When they try to sell an instrument installation, they find that the money is needed for many other purposes.

This is the day of group selling. Misunderstandings must be forgotten. An instrument company need no longer worry about other instrument companies and their slightly lower price. The important question now is "How can we sell more and better instruments? How can we divert part of industries' dollar for the purchase of instruments?"

That dollar will only go so far. Part of it must be spent for the necessary operating expenses. There are many, too many industries, trying to get the remainder. The instrument industry to get its share must sell the idea that the service it offers will give more satisfaction than the service of any other industry.

Such a selling job is far too expensive for any one company. INSTRUMENTS is performing this job very capably and efficiently. The instrument companies are urged to cooperate with INSTRUMENTS to do a "bigger and better" job.

——— :: ———

The Ostwald Color Theory

DR. SACH'S introduction to a series of articles on the measurement of color, will be found in this issue. In whatever branch of industry the color of the product is a factor, these articles will be of interest. In the textile industry, of course, accurate measurement of color is of utmost importance, especially when considering delicate shades, which easily deceive the eye.

The industries manufacturing the following products all have their color problems: inks, paints, dye, paper, lacquer, soap, oleomargarine, sugar, syrup, chocolate, glass, brick, rope, leather, cement, cosmetics, etc. Even when color is not of prime importance, manufacturers usually try to keep it uniform.

——— :: ———

Correction: Electrical Instrument Developments During 1927-8

LINE 6 from the bottom of Page 13 of the January issue, "oscillograph switchboard instruments" should read "portable oscillographs."

——— :: ———

Volume One

WE have been able to assemble sixteen complete volumes of the first twelve issues of INSTRUMENTS.

These are offered to readers at $5.00 per volume, to cover expenses connected with collecting these volumes. Volumes will not be broken.

——— :: ———

The latest use for the X-ray is to peer into the heart of a tree. With the new apparatus perfected by the Eastman Kodak Company, experts determine the extent of decay, thus safeguarding against damage from falling trees or telegraph poles. The apparatus also is useful for inspecting wooden parts of airplanes.—Popular Science.

Instrument Pioneers

Joseph Willard Legg

(1889-1929)

JOSEPH WILLARD LEGG was born January 18, 1889, in Worcester, Mass., where he attended grade and high schools. Following his high school course he made a trip around the world. In 1915 he received a Bachelor of Science degree from Worcester Polytechnic Institute, and in 1917 received a degree of Electrical Engineer from the same institution.

In 1915 he entered the employ of the Westinghouse Company. His first work was in the research department, where he assisted in the development of the mercury arc rectifier. Becoming interested in oscillograph work, he made a number of improvements in oscillograph design, notably the use of incandescent rather than arc lamps, which led to the Westinghouse Company's entering the oscillograph business. In the years that followed, he originated many schemes for automatic oscillographic work, and numerous improvements in oscillographic instruments resulted from his intensive study of the subject. Mr. Legg once traveled to South America on the steamship "Southern Cross" for the purpose of studying the vibrations that took place within the ship's turbines.

As a member of the meter engineering staff of the Westinghouse Electric & Manufacturing Company, Mr. Legg was responsible for the development of many electrical devices. His greatest fame resulted from his invention of the "Osiso," a small portable oscillograph for which many unusual uses have been found. An "Osiso" is now being used experimentally in St. Louis as a means of helping teach deaf persons to speak by making visual records of their voice waves; another is with Commander Byrd's expedition in the Antarctic, where it is being used in the study of radio "dead spots" and the reflection of radio waves; others are being used for measuring intelligence, for measuring nerve response, for studying musical overtones, for locating oil wells, for measuring vibrations on trains, ships and elevators, and for recording the history of transient phenomena taking place in electric circuits. Perhaps the most important phase of Mr. Legg's work was his adaptation of the "Osiso" to perform the functions of an electric cardiograph, which enables physicians to obtain a complete permanent record of the action of the heart.

Another invention of Mr. Legg's is the polar high-speed camera, which is capable of taking 3,000 photographs per minute. It is used in the study of rapidly-moving electric arcs.

He died at 4.30 o'clock Wednesday afternoon, January 2, 1929 from pneumonia. He had been ill less than a week. He leaves his wife, Esther Bergstrom Legg, and two children, Janet, aged 10 years, and Willard, aged 5 years.

———— :: ————

Which wear more sensible clothes, men or women? The noted German hygienist, Dr. Ernst Friedberger, found the answer by placing thermometers and other precision instruments beneath the clothing of both men and women, and so measured the temperature and humidity next to their skins. He found that the temperature next to a woman's skin is as much as ten degrees lower than next to a man's, and that the humidity is from a third to a half less.

"The average modern man spends most of his life, winter and summer, in the debilitating climate of the tropics. Only his face and hands are allowed to stick out into healthier surroundings. The average woman, on the other hand, lives in a climate like the cool, dry air of the Alps."—Popular Science.

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The Ostwald Color Theory

*Dr. Albert Parsons Sachs**

INTRODUCTION

IT is well known, of course, that our knowledge of the external world is obtained through our senses. We possess many more than the five traditional senses, but it is unnecessary at this point to enter into a discussion of the exact number and nature of our senses. Suffice it to repeat that the external world appears to us only through our senses. A crude example will help us understand how our senses unite us to the external world. A person born blind and deaf would live in a more limited world than that of the normally sensed person; the former would know the world as consisting of objects of various sizes, shapes, textures, hardnesses (sense of touch), varying in temperature from time to time (senses of heat and cold), and capable of having odors (sense of smell) and tastes (sense of taste), but no sounds or colors would exist.

The sense of hearing enables us to perceive sound. Sound is due to a vibration of the air with a frequency range of 24 to 40,000 per second. Our knowledge of sound is very great. We know that the elements of a sound which affect the sensation which we perceive are its *pitch* (rapidity of vibration), *loudness* (intensity), and *timbre or quality* (essentially the lack of purity of a given sound conditioned by the nature of the vibrating body producing the sound).

We have learned how to analyze a sound into its components, how to record certain kinds of sounds (musical notation), and we have learned many of the laws of sound harmonies (musical harmonies).

In the case of the sense of sight the situation is not quite so clear as in the case of the sense of hearing. We shall leave for later definition some of the terms which we shall use now. The eye is unable to distinguish between a pure spectral green (a green which we cannot separate by the use of prisms, gratings, etc., into components) and a green compounded of blue and yellow, a green easily separable by means of prisms, etc., into yellow and blue. This is a psychological defect of our color vision.

Although the sense of sight plays a greater part in our lives than the sense of hearing, yet the human race has achieved no such esthetic development of the sense of sight as we have of the sense of hearing. What have we in the realm of color to compare with the vast resources of our musical art? What knowledge have we of the nature of color harmony comparable to our knowledge of musical harmony?

The progress of physical science has helped music to develop an adequately basic theory, to devise new instruments, and to attain a pro-

*Consulting Engineer, New York, N. Y.

founder understanding of the nature of musical harmony. The lack of a comparable advance in the art of color is due primarily to the lack of an adequate theory of color and of color harmony. The various schools have not yet agreed as to the elements which determine a color. Color and sound are different sensations and analogies between the two are not valid but are suggestive. We know the elements of a sound to be pitch, intensity and timbre. What are the elements of a color?

Naturally the history of so complicated and continuous a subject as that of color theory cannot be compressed into the space which INSTRUMENTS can possibly allow. One of the most successful and most suggestive of recent theories is that of Wilhelm Ostwald, Nobel prize winner in chemistry (1909), one of the founders of modern physical chemistry and certainly its principal proponent, philosopher (founder and editor of the important philosophical journal Annalen der Naturphilosophie) and investigator in the field of color.

Unfortunately his theory of color, while receiving widespread recognition in Europe, particularly in Germany, is practically unknown in this country.

Artists everywhere have resisted the idea that a theory of color and color harmony could be formulated and have blindly fought against accepting the results of careful investigation. It is certain that a knowledge of the physical science of sound and sound harmony alone will not produce a Beethoven; science does not displace the artist, it merely gives the artist's talents greater scope. So similarly an ordered science of color will not make every school boy into a Titian or a Rubens, nor does it attempt to do so; the artist will know more about color and will have wider scope for his talents.

In this country, too, important early efforts were made in the theory of color and color harmony. These valuable efforts seem only to have served to make more difficult a competent presentation and just appraisal of Ostwald's efforts. Although he has written numerous books on color theory and harmony, the most elementary of which Die Farbenfibel (Color Primer), has passed through more than ten editions in Germany, it has not been found possible to publish a translation of even one in this country although complete manuscript translations are available for many of his works. The above explanation accounts for the length of introduction preceding the actual description of Ostwald's theory and the instruments used by him.

Newton was the first to achieve the possibility of an orderly arrangement of all possible colors. He discovered the relation between refractive power and color which leads to the formation of a spectrum when a beam of light is passed through a prism. The varieties of light obtained by dispersion through a prism are monochromatic and not further dispersible.

The series of colors formed depends upon the indices of refraction.

Red, at one end of the spectrum, has the lowest index of refraction, violet, at the other end has the highest. In between these two extremes we have a regular series of colors which pass almost imperceptibly from the red to the violet. In the older texts the intermediate colors, orange, yellow, green, blue and indigo were commonly named. Ostwald makes a somewhat different grouping of colors intermediate between red and violet, namely, orange, yellow, leaf-green (yellowish green), lake-green (bluish green), ice-blue (greenish blue), and ublue (ultramarine blue).

Although we arrange such a series in regular sequence it is highly desirable that we determine the essential elements of all colors and find a means to express their values numerically. As a preliminary statement we may say that Ostwald's theory is based upon the assumption (which is not universally admitted to be the complete statement of facts) that every color consists of three and only three elements, namely, a certain amount of "pure" color, a certain amount of black and a certain amount of white, each of which can be expressed numerically and can be determined precisely with the use of suitable instruments.

In concluding the introductory remarks we can do no better than quote Ostwald's own Introduction to the Color Primer:

"*COLOR.* Whatever we see consists directly of *colors* which are present in the field of vision as larger or smaller parts or areas. Where two or more meet, boundary lines result the interrelation of which gives rise to *forms* or shapes from which we deduce the presence of the objects seen.

"Colors are thus the fundamental components or elements of our visual perceptions.

"The word color, as a result of inexact language habits, is also used for materials and events from which color sensations or colors arise Materials which are used for coloring are called coloring-materials and not colors; the energy which by its action upon our eyes produces the sensation of color is called *light.*

"*CLASSIFICATION.* Colors fall into two classes:

1. the *dull* colors, white, gray, black and everything intermediate between them;
2. the *bright* colors, yellow, red, blue, green and everything intermediate between them or related to them.

"Sometimes the name of colors is limited to the bright colors and the dull colors are said to be without color. But in that case we cannot say that all visual sensations consist exclusively of colors. It is therefore more convenient to select the broader definition."

——— :: ———

Every purchaser pays the cost of selling him the goods he buys. It is the seller's business to use every means to keep the selling cost low and make the service worth all that it costs.

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Recent Developments in the Field of Magnetic Measurements

*Thomas Spooner, East Pittsburgh, Pa.**

(*Continued from January issue*)

PART II

MAGNETIC ANALYSIS

Magnetic analysis is of two types. The first consists of the detection of flaws and homogeneities by sending magnetic flux through the specimen and noting alterations in direction or magnitude or both, of the leakage flux in the vicinity of the flaw. Essentially this consists in the determination of abnormal changes in reluctance. In the second method one or more of the magnetic properties of a specimen is measured and from the results other physical characteristics of the material are deduced, such as, hardness, tensile strength, brittleness, and the like. This method may

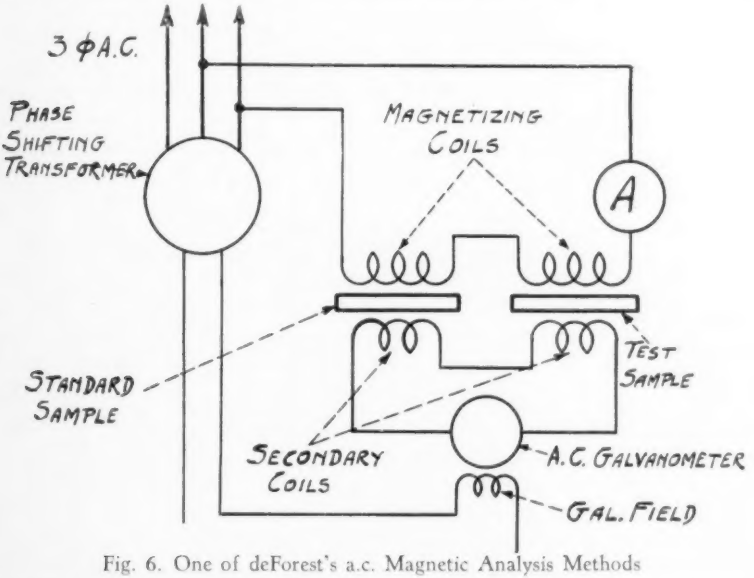


Fig. 6. One of deForest's a.c. Magnetic Analysis Methods

be used also to determine the accuracy and uniformity of heat treatment. It may even be employed to a certain extent as an indication of chemical composition.

Magnetic Inspection of Steam Turbine Bucket Wheels

A method of detecting flaws in steam turbine bucket wheels recently described by Capp[13], is a good example of the first type of magnetic analysis. The wheel under test is mounted horizontally and is slowly re-

*Research Department, Westinghouse Electric & Manufacturing Company.

[13]The Application of Magnetics to the Inspection of Steam Turbine Bucket Wheels—J. A. Capp, Proceedings of the A.S.T.M. Vol. 27, Part 2, p. 268, 1927.

volved. Small pole pieces mounted above and below cause magnetic flux to pass through a section of the wheel. If a flaw exists in the specimen under test the magnetic reluctance will be altered at that point and the corresponding change in the flux is noted by a sensitive galvanometer. The movements of the galvanometer are autographically recorded on a circular chart giving a series of circles, each corresponding to a revolution of the disc at some definite radius. This apparatus has been very effective and reliable in detecting flaws of magnitudes which could be expected to be dangerous in the operation of these high speed bucket wheels.

DeForest's Methods

Some of the recent a.c. magnetic analysis methods of DeForest[14] are good illustrations of the second type of test. A typical differential ar-

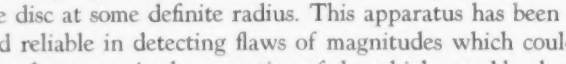


Fig. 7 Ball Bearing Tester.

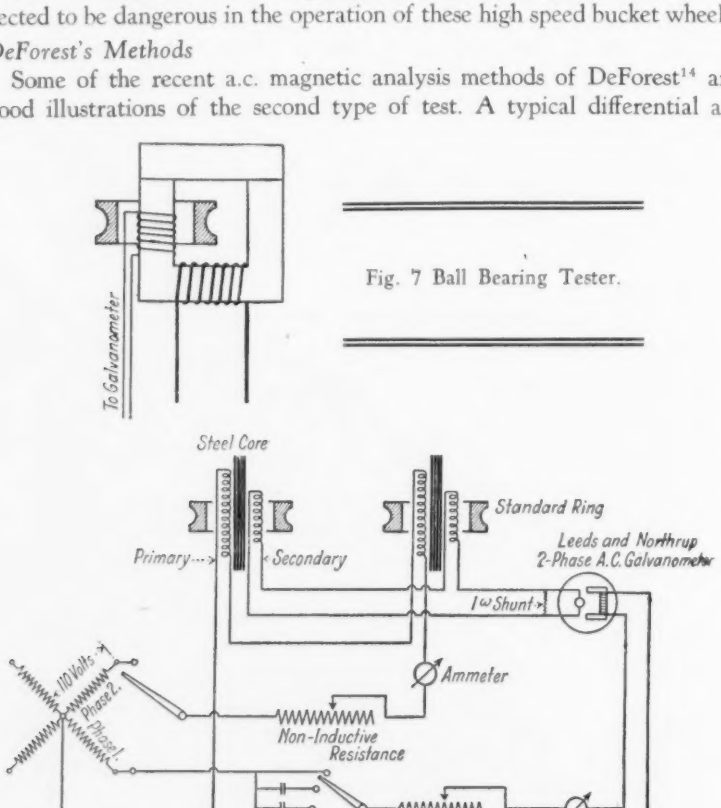


Fig. 8. Wiring Diagram of Ball Bearing Tester

rangement using an a.c. galvanometer is shown by Figure 6. One of two solenoids, each having a primary and secondary winding, contains a standard sample of known characteristics and the other the sample under test. The primaries of the solenoids are supplied from a commercial a.c.

[14]Proc. A.S.T.M. 1923-1926-1927.

circuit. The field of the a.c. galvanometer is supplied from a phase-shifting transformer, the primary of which is connected to the same a.c. supply. This makes it possible to excite the a.c. galvanometer field with any desired phase angle. The two secondary windings are connected in series opposing through the moving coil of the a.c. galvanometer. If the two test samples are alike there will be no deflection of the galvanometer. If, on the other hand, there is a difference there will in general be produced a measurable deflection. It is possible by properly adjusting the phase angle of the galvanometer field to obtain deflections which are proportional either to the permeability or to the losses in the samples or if desired by the use of specimens of known quality it is feasible to so adjust the galvanometer field phase angle that the different readings will be proportional either to quenching temperature or drawing temperature of the specimens for certain types of samples. Mr. DeForest has used this type of apparatus quite successfully for the determination of the accuracy of heat treatment and for the selection of specimens which are or are not mechanically suitable for the purpose for which they are intended. By the substitution of a cathode ray or mechanical oscillograph Lissajous figures may be obtained which give a very sensitive indication of the properties of magnetic specimens. In the hands of a skilled operator this makes a very fine device for the control of heat treating processes. It has been applied quite successfully by Mr. DeForest for the commercial inspection of certain types of heat treated tools.

Ball-Bearing Race Tests

An interesting application of magnetic analysis has been made by Dr. Styri[15] in connection with the inspection of ball-bearing races. Referring to Figure 7, a rectangular laminated magnetic circuit is arranged so that one side may be removed and a ball-bearing race placed over one leg. A primary winding carrying a.c. magnetizes the core. The race acts as a secondary winding and as a function of its permeability, hysterisis characteristics, and resistance the flux in the core is varied in magnitude and phase angle. The voltage induced in the secondary coil connected to the galvanometer is, of course, the result of variations in the core flux. By using the arrangement of Figure 8, a comparison may be made between a standard race and one under test. If the current in the field of the a.c. galvanometer is properly adjusted by means of the step arrangement of condensers it is possible by taking two readings with the phase angle of the primary current shifted 90° by means of the phase shifting transformer to obtain two sets of readings, one of which is approximately proportional to the drawing temperature and the other to the quenching temperature.

Another use for this same apparatus slightly modified has been reported more recently by Dr. Styri[16] on the endurance of high speed cut-

[15]Testing of Ball-Bearing Races by Electric and Magnetic Methods—Haakon Styri, Proc. A.S.T.M. Vol. 26, Part 2, p. 148, 1926.

[16]Endurance of High Speed Cut-off Tools in Relation to Magnetic and other Measurements. Haakon Styri, Proc. A.S.T.M. 1928.

off tools. He concludes that the magnetic method cannot be used satisfactorily on finished tools due to the fact that variations in the drawing operation have a much greater effect than variations in the quenching. He, therefore, recommends that if such a method is used for checking the heat treatment of high speed tools a test be made after quenching and another after drawing. This limits the use of the method to the tool manufacturer. In the present state of the art, other experimenters also have found it desirable to follow this procedure.

Hardness Testing of Steel Balls

Prof. Williams[17] has recently devised a simple test for the magnetic hardness of steel balls which seems to correlate fairly well with Rebound and Rockwell hardness values, see Figure 9. Two permanent magnets as indicated are placed with their poles about 20 cm. apart. Each pole tip is supplied with extension pieces as shown.

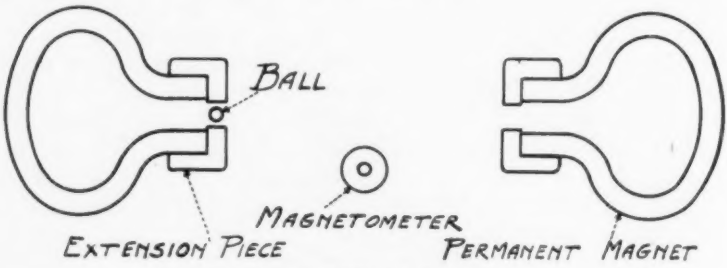


Fig. 9 Prof. Williams' Ball Tester.

Between the magnets and a little to one side is a magnetometer of the type described in a previous section as developed by Prof. Williams. If a steel ball is placed between the extension pieces of one magnet as indicated, the magnetometer will deflect. The amount of deflection depends on the quality of the steel ball and, as mentioned above, lines up fairly well with hardness tests as obtained by other means. Such an apparatus in its present form is probably not suitable for commercial testing but the results do indicate that a magnetic tester for steel balls might be worked

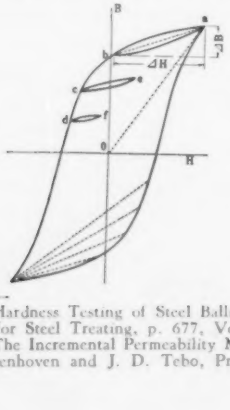


Fig. 10 Incremental Hysteresis Loops.

[17]Hardness Testing of Steel Balls for Magnetic Methods. S. R. Williams, Trans. of American Soc. for Steel Treating, p. 677, Vol. 2, Jan. to June, 1927.

[18]The Incremental Permeability Method for the Magnetic Analysis of High Speed Steel. W. B Kouwenhoven and J. D. Tebo, Proc. A.S.T.M. 1928.

out along these lines which would be of considerable value commercially.

Incremental Permeability Tests

Kouwenhoven and Tebo[18] have described a type of test called the incremental permeability method which shows some promise in connection with magnetic analysis problems. Referring to Figure 10 the incremental permeability ($\mu\Delta$) is given by the slope of the line connecting the tips of a minor hysteresis loop such as the points a-b, or c-e, where $\mu\Delta = \frac{\Delta B}{\Delta H}$

A measure of this incremental permeability by suitable means for an unknown sample as compared with a specimen of known properties or treatment gives a sensitive means of determining differences in physical or chemical properties or heat treatment. These measurements may be made by d.c. or a.c. methods and may be direct or may be obtained by differential arrangements. Several possible methods are described by the authors in the original article which should be consulted for details.

Sperry's Rail Tester

One of the most important and interesting developments recently reported is Sperry's method[19] for detecting defects in steel rails. His latest

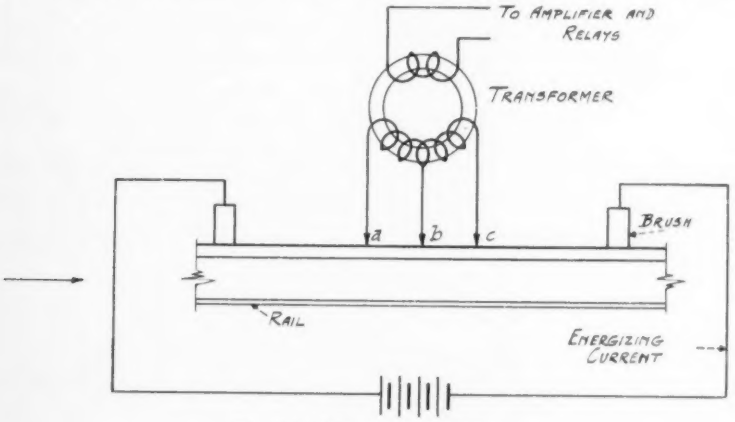


Fig. 11. Sperry's Rail Tester

arrangement consists of a combination electric and magnetic device which is said to be particularly effective in picking out transverse cracks or flaws. These tests can be applied by a test car moving on standard track. A direct electric current of fairly high ampereage is caused to pass through a short section of the rail through brushes which rest on the track. The indication of a defect is obtained as follows. (See Figure 11.) The energizing current passes through the rail as indicated. Under normal conditions the two primary coils on the transformer connected to the rail contacts a, b, c produce no flux in the transformer core since they

[19]Non-Destructive Detection of Flaws. Elmer A. Sperry, The Iron Age, p. 1214, Nov. 15, 1928.

are connected differentially. If, however, a transverse fissure or flaw is present between a-b or b-c, the current becomes unbalanced, flux passes through the transformer core, and a voltage is induced in the secondary winding. This voltage is amplified, produces a signal if desired, and squirts paint on the track at the point of the defect. This device should be of enormous value in improving the safety of rail travel.

The Duroscope

Mr. Sams[20] has recently described a magnetic device which tests the quality of a specimen over a small area just as is the case for the Scleroscope or Brinell tester. This device, known as the Duroscope, consists essentially of two concentric magnetic cylinders or the equivalent supplied with a magnetizing winding and a secondary winding. The magnetic circuit between the two cylinders is closed by the specimen to be tested. The magnetizing winding is supplied from a.c. and passes through the current coil of a wattmeter. The Duroscope secondary coil is connected to the moving coil of the wattmeter. Now, if a.c. is applied and the Duroscope pencil, as the small concentric cylinders are called, is applied to a magnetic surface to be tested, the readings of the wattmeter will be a function of the loss in the specimen at the particular spot under test. The Duroscope may be compensated internally or externally by a variable core transformer so that the wattmeter reads zero when the pencil is not applied to a sample, or, if desired, two Duroscope pencils connected differentially may be used, one applied to a specimen of known and desired quality and the other to the unknown. The wattmeter will then indicate the difference in the two specimens. These Duroscope pencils are made in a variety of forms, for smooth and for rough surfaces. The magnetic indications seem, in general, to line up fairly well with the measured hardness as determined by mechanical means and also the known heat treatment.

Part III

MAGNETIC SURVEYING

If ore bodies containing appreciable amounts of ferro-magnetic materials exist near the surface of the earth, the magnetic lines of force of the earth's field will be appreciably distorted in the region of these ore bodies. It has been possible in the past by the use of delicate compasses and dip needles to obtain some indication of these distortions and thereby predict the presence of magnetic materials below the earth's crust. Some improvement on the old type of needles has been made by the use of very sensitive magnetic balances. These, however, have certain very definite limitations as regards sensitivity and reliability.

Quite recently Rieber[21] has described a new device which seems much superior to any which have heretofore been available for this purpose. One of the latest forms of this device is shown by Figure 12. This con-

[20]The Duroscope, an Apparatus for the Magnetic Determination of the Durability of Steels. J. A. Sams, Proc. A.S.T.M. Vol. 27, p. 252, 1927.

[21]A New Micro Magnetometer. American Inst. of Mining and Met. Engrs. Tech. Publication No. 119. (Issued with Mining and Met. July 1928.)

sists essentially of a modified Einthoven galvanometer, except in this case the variable is the field rather than the current in the wire. Alternating current of considerable magnitude from a 100 cycle oscillator passes through the wire as indicated. The movement of the wire is observed on a screen by reflecting light from an incandescent lamp through two prisms as shown. If the wire vibrates a blurred image is seen on the screen the width being proportional to the amount of vibration of the wire. For the greatest sensitivity the natural period of the wire is made equal to that of the a.c. supply. Magnetic pole pieces consist of a special alloy material having very high permeability at low inductions (probably one of the new nickel-iron alloys of the permalloy or hipernik type). If this device is placed in a magnetic field such as the earth's field, sufficient flux will pass across the air gap containing the wire, to cause the wire to vibrate. If the magnets are oriented so that their axis is at right angles to the field, the flux becomes zero and the wire ceases to vibrate. This gives an accurate measure of the direction of the magnetic field. It is said to be possible to duplicate orientations to an accuracy of 0.001 of a degree. In order to obtain this accuracy it is necessary to eliminate hysteresis effects. This is done by passing alternating current of a different frequency from a second oscillator through windings on the core as shown in Figure 12. If it is desired to measure the strength of the mag-

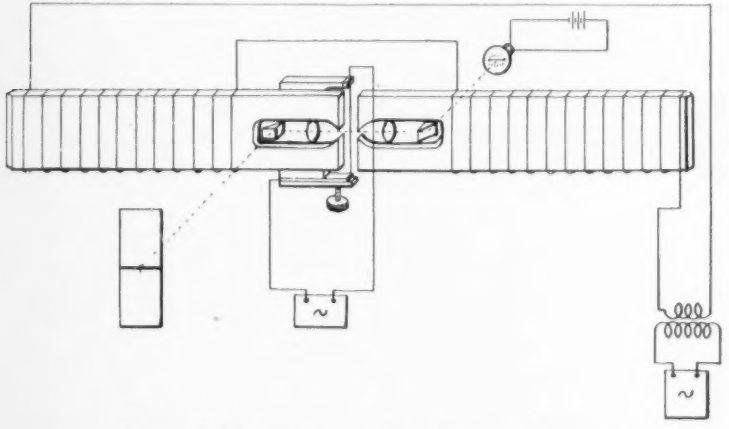
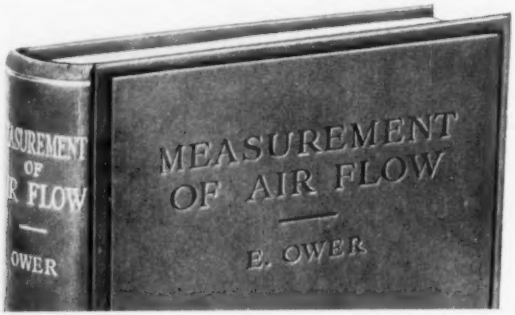


Fig. 12. Micromagnetometer for Magnetic Surveying

netic field, either the vertical or the horizontal component, the poles are oriented for a maximum deflection and direct current is passed through windings on the poles of such a value and polarity as to reduce the flux in the device to zero as indicated by zero deflection of the vibrating wire. By the use of a potentiometer an accuracy of perhaps .01% may be obtained. This very ingeneous device should make possible much more accurate magnetic surveys than have been obtainable in the past. It is said to have an apparent accuracy over 30 times that of typical field balances.



The Measurement of Air Flow

By

E. OWER, B.SC. (LOND.), HONS. I., A.C.G.I.

Bramwell Medallist; Member of the Institute of Heating and Ventilating Engineers; Assistant in the Aerodynamics Department, National Physical Laboratory.

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Specific Gravity and Viscosity

*H. L. Hazeltine**

(*Continued from December issue*)

"THE viscosity of the varnish shall not be less than .885. The viscosity will be taken as the specific gravity of the varnish two coats of which will produce a 3 to 3½ mil wall in the center of the test piece."

This is a verbatim quotation from a varnish purchasing specification. The writer has drawn a clear picture of his requirements but from the wording it is evident that he has not grasped the complete significance of the terms—Specific Gravity and Viscosity—nor their relation to varnishes and paints.

This confusion is by no means a rare occurrence perhaps because many of the conditions which affect Specific Gravity will also affect Viscosity, such as a change in the amount of non-volatile content or a change in the type of solvent.

The terms Specific Gravity and Viscosity have nevertheless distinct meanings and must be considered separately if a true picture of a given material is to be obtained.

Specific Gravity deals with the relative weights of substances; Viscosity with the relative flowing characteristics.

Viscosity is variously defined as "the resistance of a substance to shear," as "internal friction," as "the resistance to flow" due in the case of solids and liquids to the mutual attraction between molecules.

Since no practical method is available for measuring these internal forces their effect has been chosen as the best means for judging viscosity, namely: the time rate of flow of the substance under the influence of the force of gravity.

Like Specific Gravity, Viscosity is a relative term and the rate of flow must be compared to the rate of flow of some other substance chosen as an arbitrary standard. Thus we have:

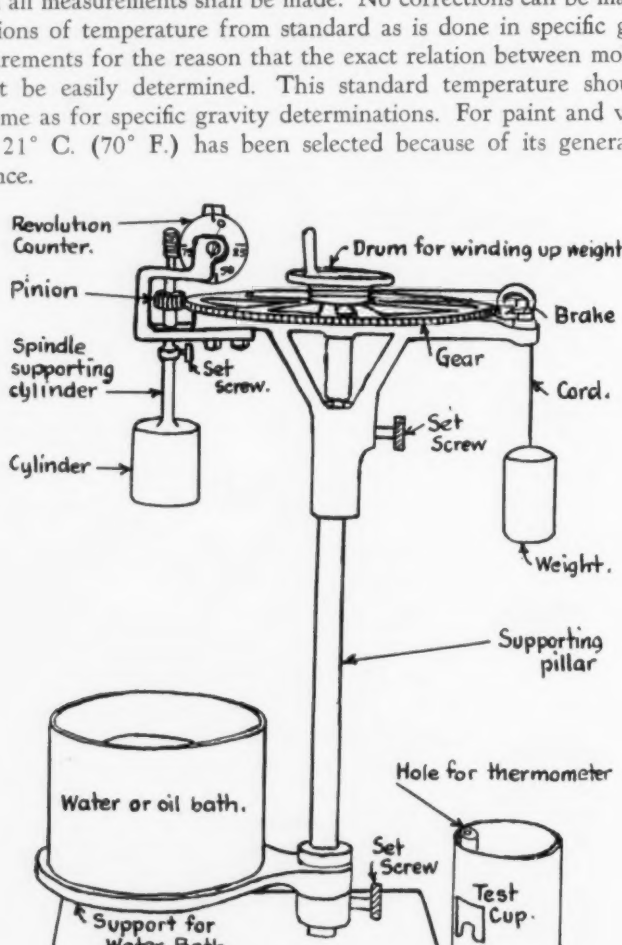
$$\text{Specific gravity} = \frac{\text{Weight per unit volume of a substance}}{\text{Weight per unit volume of distilled water.}}$$

$$\text{Viscosity} = \frac{\text{Rate of flow of a substance}}{\text{Rate of flow of distilled water.}}$$

An increase in the temperature of most substances causes an increase in volume. Since this results in an increase in the distance between molecules, the force of attraction between them must decrease and hence the viscosity must decrease . This change in viscosity with temperature is very marked in many cases, particularly with paints and

*Engineer of Insulation, Sterling Varnish Co., Haysville, Pa.

varnishes; hence it is highly important that the temperature shall be closely controlled during tests and that some standard shall be set at which all measurements shall be made. No corrections can be made for variations of temperature from standard as is done in specific gravity measurements for the reason that the exact relation between molecules cannot be easily determined. This standard temperature should be the same as for specific gravity determinations. For paint and varnish work 21° C. (70° F.) has been selected because of its general convenience.



Viscosity is measured by means of an instrument called a viscosimeter of which there are many types on the market. These may be divided into two general classes—those that measure the rate of flow through an orifice and those that do not. While suitable for use with oils, etc. the former type is not suitable for testing drying materials, such as paints and varnishes, because of the danger of obtaining a partial closure of the orifice due to the oxidation or drying of the material at that point.

The Stormer and MacMichael viscosimeters are two instruments not of the orifice type and are therefore approved for paint and varnish determinations.

The fundamental principle of the Stormer instrument is based upon the shearing action of a cylinder which is caused to rotate in a test cup by means of a falling weight acting through a spindle, a gear and pinion. The greater the resistance to shear, the slower will be the motion of the cylinder. The test cup is surrounded by a water bath to maintain the desired uniform temperature. To the spindle which supports the cylinder a revolution counter is connected. The test cup is held concentric with the cylinder by three arms projecting inward from the wall of the water bath while it is prevented from turning by a stop plate engaging one of these arms. The water bath is kept in position by a recess in its support which can be raised or lowered to any desired position.

In making the test the cup is filled to the top of the two fins projecting inward. It is then placed in position with the stop plate on the side projecting arms of the water bath. The cylinder is pushed up as far as it will go on the spindle and secured with a set screw. The test cup and water bath is now raised on the pillar to such a position that the liquid covers the top of the cylinder, care being taken that the cylinder shall be free to rotate without rubbing. The cylinder should always be immersed to the same depth in order that consistent results may be secured. The string attached to the driving weight is wound up on the drum and the dial of the revolution counter is adjusted so that it is at the left of the zero mark. A thermometer placed in a hole inside the test cup records the temperature. The brake is now released and the time taken with a stop watch when the pointer passes the zero mark. When the pointer again passes the zero mark, 100 revolutions have been made by the cylinder and the time should again be taken. At least five readings are necessary to insure accuracy.

Viscosity is obtained by dividing the time required for the cylinder to make 100 revolutions in the substance under test by the time required for 100 revolutions in distilled water at the same temperature. Thus if at 21° C. 25 seconds are required for 100 revolutions in a certain material while 5 seconds are required for the same number of revolutions at the same temperature with distilled water, the viscosity of the substance is 25 divided by 5 or 5.

Like Specific Gravity, the viscosity of varnishes depends upon the percentage of base or useful material and upon the nature of the solvent. In addition it is affected by the nature of the non-volatile content. Since these vary with different materials, the test should never be used as a basis of comparison of two or more varnishes. It may be used as a control test to determine the constancy of shipments of the same material.

When so used, however, care should be taken in writing the speci-

fications to see that the maximum and minimum limits are as far apart as the constancy of the shop results will permit. When the limits are too narrow the varnish manufacturers are forced to either vary the specific gravity or vary the type of solvent. In either case the percentage of base or useful material will vary.

Since the useful material is that portion of the varnish that gives the desired protection to treated pieces it is important the percentage shall be held constant so that the purchaser may receive full value for the money expended.

Viscosity measurements are sometimes, in conjunction with specific gravity readings, used for shop control on work requiring that the thickness of film deposited shall be uniform. Unfortunately film thickness does not depend altogether upon specific gravity and viscosity.

———— :: ————

In 1912 the manufacture of a wax sensitized paper for automatic recording on graphic recording instruments, was attempted. This product was produced on a very limited scale and a very inferior quality product was turned out for a few years. In spite of the shortcomings of the product at that time, its value was so great for special applications that it was adopted by a number of manufacturers of recording instruments. The original concern manufacturing this product went out of business a number of years ago and the stocks on the market were exhausted shortly thereafter.

Numerous manufacturers applied to the Mayer Coating Machines Company for the production of this article. Through their extensive experience, with processes of paper coating, it was believed they could successfully perfect the article. Their engineer, E. F. Siller, after devoting two years research to the formula and processes, succeeded in perfecting both. The Stylograph Company was then formed to take over the manufacture and distribution of this article.

The Stylograph Company is now approaching its fourth year of production and has succeeded in so highly standardizing the product and retaining it at such a high degree of uniformity, that they have met with exceptional success. The chart stock is produced with a scientific degree of accuracy controlling uniformity of reproduction.

The assurance to manufacturers of recording instruments of the permanent presence on the market of this product has induced several to bring out new models of their instruments especially designed for the use of this paper. It has also been possible to adapt the stock for some existing recording instruments on the market by slight adjustments or changes. The use of Stylograph for recording instruments has also created a new sales appeal to users of these instruments by making it possible to equip these instruments with permanent stylus points that require no attention throughout the life of the instrument and eliminate the attention, reconditioning and care required by devices using ink or other methods.

Searching for Information on Instruments & Measurements

*Richard Rimbach and M. Berg Rimbach**

(*Continued from January issue*)

INDIVIDUALS who do not have the matter called especially to their attention neglect one of the most helpful sources of information because they do not make use of periodical material to any great extent. They usually go to a card catalogue and take the best they can find there, making no attempt to get material that has appeared in periodicals. Articles in periodicals are preferable to material found in books as:

1. They are usually short and therefore give the meat of the matter in brief form.

2. They are likely to be somewhat more specialized than books as each deals with a single thing and therefore has a different view point than a book.

3. They are written for the general reader and therefore are likely to be more interesting and practical than books.

4. They are much more recent. The time required for writing and publishing books makes it impossible for them to contain the latest information.

Very often considerable information on instruments and measurements can be found in the literature issued by instrument companies (catalogues and house organs). The average present-day catalogue in many cases contains information more up-to-date than that contained in books. Details of manufacture and operation of the instrument are given in considerable detail; the literature being the result of no small effort and expense on the part of the instrument manufacturers.

LIST 6. HOUSE ORGANS AND PERIODICALS PUBLISHED BY COMPANIES MANUFACTURING INSTRUMENTS

A. E. G. Mitteilungen
Bausch & Lomb Magazine
Brown Boverie Review
Electric Journal
Experimenter
Gas Service Journal
General Electric Review
Instrument Investment News
Laboratory
Microscope Record
Siemens Zeitschrift
Sperryscope
Tycos Rochester
Water Works Journal

Development and research departments of instrument manufacturers and in some cases other companies, busied with the design and development of instruments for scientific and industrial use will also desire to make a search of the patent literature, either for the purpose of obtaining information for patent or other purposes. Practically all the patents

*Editor and Associate Editor of INSTRUMENTS, respectively.

of importance will be found in the patent journals of England, Germany and the United States:

England—Illustrated Official Journal
Germany—Patentblatt & Auszuege aus den Patentschriften
United States—Official Gazette

The classified compendia issued by the British Patent Office will be found very useful as the British Office data are classified according to subject. In the Patentblatt the instrument patents are collected under one division entitled Class 42 and this is subdivided into sections for certain classes of instruments. The following instrument journals also have patent reviews:

Instrument World
INSTRUMENTS
Messtechnik
Zeitschrift fuer Feinmechanik und Praezision

Of these INSTRUMENTS is the only one which covers all the instrument patents in the above listed patent journals.

As regards the availability or sources of supply of certain instruments it is a comparatively simple matter to find the information on the most instruments. These will be found listed in the advertising pages and buyer's guides of the periodicals in Lists 4 and 5 or in the following:

Brown's Directory of American Gas Companies and Gas Engineering and Appliance Catalog
Chemical Engineering Catalog
Joly's Technische Auskunftsbuch
Keystone Coal Mining Catalog
McGraw-Hill Electrical Engineering Catalogue
Mac Rae's Bluebook and Hendricks Commercial Register
Mechanical Engineering Catalog
Sweet's Condensed Catalogues of Mechanical Equipment
Thomas' Register of American Manufacturers

The difficult thing is to obtain information on the manufacturers of special instruments and measuring devices, on which printed literature usually is not available, or which are not manufactured in the United States. The Information Section of the National Research Council and of INSTRUMENTS can usually furnish such information. The National Research Council Information Service maintain a file of over 500 catalogues—representing the manufacturers and dealers in scientific apparatus and instruments, both domestic and foreign. The Information Section of INSTRUMENTS has at its disposal about 600 catalogues, the books and periodicals in the lists above, in addition to the services of its collaborators, all specialists in their particular fields. Both of these information services are promptly furnished without charge.

The searcher will naturally be guided by the kind of instrument or test on which he desires information, so that very frequently much time may be saved by consulting the periodicals devoted to this immediately without going through all of those listed above.

In order that the man interested in instruments may keep abreast of the latest developments in this field, it is advisable that he read regularly at least two of the following:

INSTRUMENTS
Journal of Scientific Instruments
Messtechnik
Zeitschrift fuer Instrumentenkunde

No claim is made by the authors that this information is complete although every effort was made to have it so. All readers are earnestly requested to send in any additions or corrections, as well as suggestions. These will be used in a future article.

New Instruments

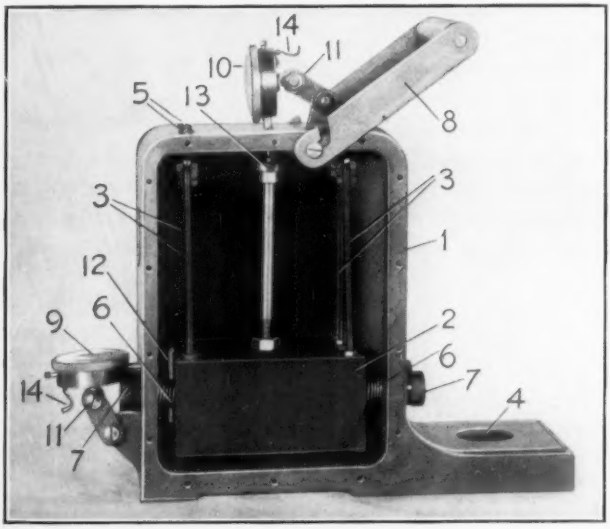
Recently Developed by Instrument Manufacturers

Vibrometer

(Vibration Specialty Company)

POWER-HOUSE engineers are requiring higher standards of performance from their machinery. A closer check is being kept on the operation both electrical and mechanical. Much attention is being paid to the vibration of power units. It is important for the engineer to know the magnitude of the vibration of his machines, especially during starting or while changing load.

Application. The instrument described below is designed primarily to serve as permanent equipment on power unit. It has the necessary requirements of ruggedness, simplicity and reliability. It measures both horizontal and vertical vibrations and their magnitudes are easily read in thousandths of an inch on two dials.



The instrument may be used also to measure foundation or floor vibrations due to any cause. It is made conveniently and safely portable.

The PH-8 is a standard type of a power-house vibrometer; its operating frequency range is from 300 to 2400 per minute. This instrument is

therefore suitable for use with all rotating machinery operating at a speed of 1800 R.P.M., the speed used in most of prime movers.

Description of the Vibrometer: The instrument is shown in the illustration with the side covers off. A mass (2) is suspended on eight coil springs (3, 3) from a heavy frame (1).

The frame is bolted to a bearing pedestal or to any other part if so desired. The hole in the bracket (4) is 1⅝ inches in diameter. The bottom of the frame is machined, so that the instrument can be placed on any horizontal surface, for instance on a floor for vibration measurements.

The position of the mass (2) can be adjusted by the four screws (5, 5) in the top of the frame. Four horizontal centering springs (6, 6) hold it in place. Four holes are tapped in the mass (2) in line with corresponding apertures in the frame. Lock-screws (7, 7) are put into these holes to make the mass (2) fast to the frame (1) for transportation. A detachable handle (8) is provided for carrying the instrument.

The dial indicators (9 and 10) graduated in thousandths and half-thousandths of an inch are mounted on holders (11, 11), so as to be in contact with hardened plates (12 and 13) on the mass. They show the magnitude of the horizontal and vertical vibrations. .0005-inch can be read and .0001-inch can be estimated easily on the dials. The hands of the indicators follow the oscillation of the vibrating body and their extreme positions on the dial define the magnitude of vibration. These can be seen very distinctly.

The indicators are provided with stops (14, 14), locking the plungers in an off-block position. This is to prevent continuous needless operation of the indicator mechanism, thus greatly prolonging the life of the instrument when used as permanent equipment on a unit.

Felt dampers are mounted on the side-covers to steady the operation of the mass and indicators.

The weight of this vibrometer is about 38 pounds.

The overall dimensions of it are 12 x 12 x 4½ inches.

——— :: ———

"Advertising is the backbone of America's prosperity. Every successful business can base its results on advertising. People who are half successes could treble their earnings if they would only advertise properly. Answer me this: How is anybody going to know what you see or what you do unless you tell them? Thousands in America will never know what it means to advertise until they try it. A man gropes in the dark and smothers his own heroic effort when he fails to advertise.

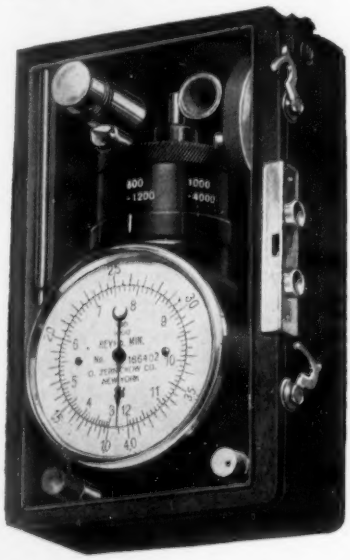
"You, yourself, are an advertisement.

"I've seen hundreds of business failures turned into thundering successes when a believer in advertising took the helm of that sliding concern."—Chas. E. Carpenter.

O-Z Tachometer

(O. Zernickow Company)

THE construction of O-Z tachometers is simple and there are no unnecessary parts or connections. Many years of experience have enabled us to select and treat the different materials entering into the manufacture of O-Z tachometers, so that each part will stand up far beyond the limit of its functions with a negligible amount of wear.



All parts are well made and accurately fitted together. The springs are aged and do not change in use so that the initial accuracy is retained indefinitely.

The spindles are of steel, hardened and ground. They run in ball and bronze bearings throughout The gears are of steel and bronze, cut on precision machines, burnished in the same manner as the finest watch wheels.

The housing of O-Z tachometers is made of aluminum alloy, black enameled with polished bezel ring.

These tachometers are of the single spindle, triple, quadruple and quintuple, selective range type. In contrast with the former well known design, the new improved O-Z hand tachometers have no sliding gear shift or similar troublesome mechanism for engaging the different ranges. The gear shift of the improved O-Z hand tachometer is of the rotating type. The shifting is done in a most efficient and simple manner, by turning the tachometer barrel with the thumb and index finger of the hand holding the instrument, until the desired range is in line with the dial center and a spring lock is felt to engage inside.

The O-Z tachometer has many advantages. Above all, the size has been reduced considerably, as may be seen from

the accompanying photograph. The new O-Z tachometer is of a pocket size, as small as it is possible to make such an instrument, without sacrificing any of the qualities for ruggedness and accuracy. Furthermore, all the troubles and repairs, due to forcing a sliding gear shift, have been eliminated.

O-Z tachometers have ball-bearing spindle. Freezing of the spindle cannot occur and, therefore, many repair bills are saved. There are only two oiling positions. Just think what that means to the men in the shop.

These tachometers are made for speeds from 20 up to 40,000 R.P.M., speeds heretofore impossible to obtain with such instruments. It is easy to imagine the lasting performance that will be obtained on the lower speeds with an instrument built to stand up at 40,000 R.P.M.

The indicating mechanism is actuated by a double cross pendulum with links operating the plunger on opposite sides which eliminates all side friction which might affect the accuracy. Exhaustive tests have shown that the error due to friction in O-Z tachometers is not within the power of observation.

The principle is that an inertia wheel, driven by gear and pinion, takes up all shocks and vibrations and imparts a steady swinging motion to the indicating hand, without in the least affecting the sensitive and accurate function of indicating speeds and the slightest speed variations instantly.

O-Z hand tachometers indicate accurately without timing or calculating of any sort:

a. The R.P.M., right or left, of revolving objects (shafts, spindles, etc.)
b. The surface or peripheral speeds in F.P.M., right or left, of traveling objects (flywheels, pulleys, belts, drums, lathes, planers).
c. Speed variations occurring during a fraction of a revolution.
d. Belt slipping and, consequently, waste of power.

The moment the pointer or cutmeter wheel is held against the object under test, the readings are taken instantaneously—at a glance.

Applications

Water power houses, public service light, heat and power stations for accurate adjustment of turbines and generators, etc. Manufacturers and users of electric apparatus, motors, turbines, pumps, blowers, automobiles, trucks, tractors, steam engines, marine engines, etc., for regulating their product to the proper standard and to keep up the output. Cotton, woolen, silk and other textile mills for testing spindle speeds and speeds of all other machinery in their plants. Machinery, machine tool and engineering works. Iron and steel mills. Elevator manufacturers. Car builders. Railroad shops. Makers of agricultural machinery. Sewing machine manufacturers. U. S. Government: Army, Navy, Aviation, Ordnance, Shipping Board. Paper, pulp, and chemical works. Alkali, dyestuffs and explosive plants. Tire and rubber manufacturers. Shipbuilders. Stock yards. Collieries. Clock, instrument and tool makers. Universities, technical schools, colleges, etc.

Catalogue Library

Check any of the publications you want. Remove the page and send with coupon to INSTRUMENTS. They will be forwarded to you without cost or obligation.

Balance-Quick Weighing

Julian H. Becker, Delft, Holland, have issued a leaflet on their quick weighing balances. This is printed in English.

Brinell Microscope

Druckschrift Pruef. 7 published by F. Staeger & Co., Berlin-Steglitz briefly describes their new Brinell Microscope construction. This is printed in German.

Chemist-Analyst

The January, 1929 issue of the Chemist Analyst, published by J. T. Baker Chemical Company, Phillipsburg, N. J. contains the following articles of interest: Determination of Sulphur in Metallic Antimony; Aluminum in Steels; Rapid Determination of Nickel in Steel and Iron; Determination of Molybdenum in Steel; Laboratory Suggestions.

Direct-Reading Permeameter

A reprint from **Instruments** Vol. 1, No. 12 is now available for distribution by Frank P. Fahy, 441 Lexington Ave., New York, N. Y.

Duroskop

The Duroskop, a hardness tester for metals and the Dwarf Brinell Press are described and illustrated in a recent booklet issued by Frankenwerk, Bad Kissingen, Germany. This is printed in English.

Electric Arc Welding with Alternating Current

The Martindale Electric Company, 1260 West 4 St., Cleveland, Ohio, have issued a booklet with the above title.

Experimenter

The January issue of the Experimenter published by the General Radio Co., Cambridge, Mass., contains the following articles: Units of Electrical Transmission; How and Why the Talkies.

How I Meet My Competitor's Attack

is the title of a recent direct mailing of the Bristol Co., Waterbury, Conn. and covers "Carburizing tool steel under automatic heat control."

Infra-Red Spectrograph

A leaflet on the Infra-Red Spectrograph has recently been issued by Kipp & Zonen, Delft, Holland. This is printed in English.

Pyrometer Switch

Claude S. Gordon Co., 708 W. Madison St., Chicago, Ill., have issued a leaflet on a double pole platinum contact pyrometer switch.

Twist Drill and Tap Gauge

Brown & Sharpe Mfg. Co., Providence, R. I., have issued a leaflet on their Twist Drill and Machine Tap Gauge No. 707.

Strain Gage, Telemeter and Tensometer

A catalogue published by Southwark Foundry and Machine Company, 400 Washington St., Philadelphia, Pa., covers the McCallum-Peters Electric Telemeter, the Whittemore Strain Gage and the Huggenberger Tensometer.

Transit Level and Dumpy Level

Brandis & Sons, Inc., 754 Lexington Ave., Brooklyn, N. Y., have issued a leaflet on their Brooklyn Transit Level and Dumpy Level.

Two-in-One Megohmer

Bulletin 160 on the "2 in 1" Megohmer has been issued by Herman H. Sticht & Co., 21 Park Row, New York, N. Y.

Tycos-Rochester

The January issue of Tycos-Rochester published by the Taylor Instrument Companies, Rochester, New York, N. Y. has the following articles: 130 New Weather Stations on 5,500 miles of Civilian Airways; The Psychology back of the Weather Forecast; Can Life exist at Absolute Zero; Humidity Test Equipment; Charting the Milky Way and Facts and Legends about Waterspouts.

Water Stills

The New Standard S. G. Barnstead Water Stills are described in a leaflet issued by Teschner-Myers Co., Inc., 43 Warren St., New York, N. Y.

What Constitutes Safe Insulation?

Bulletin 146 published by Herman H. Sticht & Co., 21 Park Row, New York, N. Y. is entitled "What Constitutes Safe Insulation?"

Vacuum Thermocouple

A New Vacuum Thermocouple of extreme rapidity for measuring radiation is covered by a recent leaflet issued by P. J. Kipp & Zonen, Delft, Holland. This is printed in English.

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Radiation, Optical and Insertion Pyrometers for the measurement of High Temperatures.

PYROMETER INSTRUMENT CO.
50 Howard St., New York, N. Y.

Level-Convertible

Folder F of Geier & Blubm, Inc., Troy, N. Y., describes the G & B Convertible Level.

Longer Life for Your Thermocouples

Claud S. Gordon Co., 708-712 W. Madison St., Chicago, Ill., have issued a leaflet on thermocouple tubes.

Laboratory

Vol. Two, No. One of the Laboratory, published by the Fisher Scientific Company, 711 Forbes St., Pittsburgh, Pa. contains the following articles: Sir Humphrey Davy; Authority—Responsibility—Negligence in the Laboratory; The Treatment of Laboratory Accidents; Laboratory Ventilation and The Gas Mask in the Laboratory.

Microscope Record

The January issue of the Microscope Record published by W. Watson & Sons, Ltd., 313 High Holborn, London, W. C. 1, England, contains: Current Microscopy-Photomicrography; Hints to Beginners; A Microscopist's Method for Testing Objectives and Getting the Best out of the Abbe Illuminator.

Megohmer—Model DM

Bulletin 170 issued by Herman H. Sticht & Co., 21 Park Row, New York, N. Y., covers the Model DM Megohmer, a combined Megohmmeter and Voltmeter.

Oil Pressure Gauges

A recent leaflet of the Rochester Manufacturing Company, Rochester, N. Y., covers their three types of Oil Pressure Gauges.

Potentiometers

Bulletin E-4 issued by the Gray Instrument Company, 64 West Johnson Street, Philadelphia, Pa., covers the "Queen" Potentiometers and accessory instruments for electric measurements in all industries.

Techniques

An exhaustive treatise on drawing and rendering in pen and ink has been reprinted. Architects, and instructors in architecture and allied subjects may obtain a copy of "Techniques" gratis, provided the request is made upon a personal or business letterhead, or by stating their business or educational affiliations. To students and all others, a charge of 25 c per copy will be made. Requests should be addressed to Educational Department, Chas. M. Higgins & Co., 271 Ninth Street, Brooklyn, N. Y., or to this magazine.

Current Literature Review

Abstracts on instruments of interest to instrument readers

Chemical Tests of Wire. J. D. Brunton, Wire & Wire Products, Nov. 1928, pp. 368-370.

Tests are described which do not require the elaborate technique or facilities of the metallurgical chemist.

Spectographic Analysis. E. Schumacher, Sci. Amer., December, 1928, pp. 530-531.

The principle of the method is briefly given and the applications are discussed.

A New Quartz Spectograph. F. Stanley, Instr. World, November, 1928, pp. 197-198.

The instrument, manufactured by Bellingham & Stanley, is described as well as the examination of all non-ferrous alloys.

Choice of Magnification in Microscopy and Photomicrography. H. Hauser, Instr. World, Nov. 1928, pp. 199-200.

Reprinted from the Bush Optical Co. technical bulletin. The article is a short summary of the most suitable magnifications to be used in the various fields of research.

Some Developments in the Routine Pressure-Testing of High-Voltage Cables. E. A. Beavis, Jl. Inst. Elec. Engrs., Oct. 1928, pp. 1086.

The difficulties experienced in connection with cable-ends when testing at high voltages in air is taken up in this paper, and results are given.

Measurement of High Vacua for large Rectifiers. (Hochvakuum-Messeinrichtung fuer Grossgleichrichter). W. Menger, El. Zeitschr, Oct. 11, 1928, pp. 1512-1513.

Description of equipment manufactured by Heraeus, Inc., consisting of a permanently heated wire in the vacuum and one or more thermocouples in series. The wire gets the hotter the greater the vacuum and permits in this way the constant observation of the latter.—Ha.

Measurement of Magnetic Fields and Field Changes by Means of the Magnetion. (Messung von Magnetischen Feldern und Feldaenderungen mit dem Magnetion). M. Roessiger, Zeits, f. Phys., Vol. 43, p. 480.

Method given which permits measurement of fields of 10^{-5} gauss.

Inspection Methods and Their Application. F. Colvin, Amer. Mach., Nov. 15, 1928, pp. 773-775.

This instalment covers the inspection of gears.

The Errors Associated with High Resistances in Alternating Current Measurements. R. Davis, Jl. Sci. Insts., Oct., 1928, pp. 305-312.

This article covers: (1) Some of the properties of a resistance which is shielded at a known potential; (2) Effect of adding a number of these units in series; (3) Method for determining the characteristics of a unit; (4) Practical limitations which may manifest themselves in the designing of a shielded resistor.

Improved Arrangement for Integrating Photometer. B. P. Dudding & G. T. Winch. Jl. Sci. Insts., Oct., 1928, pp. 312-315.

This paper gives details of a new simplified type of photometer head incorporating Lummer Brodhun contrast prisms and a sector disc. The advantages of the arrangement are stated.

An Expansion Method of Measuring the Peltier Coefficient. G. W. Todd. Jl. Sci. Insts., Oct., 1928, pp. 315-320.

This article develops an expression in terms of the Peltier coefficient and other properties of the metals forming the couple.

The Bellati-Dynamometer of Very High Sensitivity. (Ein Bellati-Dynamometer sehr hoher Empfindlichkeit) A. Pfeiffer, Ann. Phys., Vol. 84, p. 395.

Describes a new arrangement of a piece of soft iron suspended to rotate freely in a magnetic field of a solenoid. The deflection is measured by a mirror of 1 mm^2 surface, the sensitivity is 1.8×10^{-8} amperes.—Ha.

Automatic Control for Mercury-Arc Rectifiers. H. T. Seeley. G. E. Rev., Oct., 1928, pp. 537-541.

Fundamental divisions of the control: temperature, pressure, starting and stopping, switching protection, A.C. and D.C. Systems, equipment and operation.

Balancing of Rotors in Factory and at Installation. S. H. Weaver. G. E. Rev. Oct., 1928, pp. 542-545.

Article discusses measurement and location of bearing forces, simple beam and lever relations applied to unbalance, balancing of an essembled machine, mathematical analysis of forces, and quartering curves.

FEDERAL
DIAL INDICATORS

Comparators
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Cylinder Gauges
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400 Washington Avenue Philadelphia, Pa.

The following flush type power plant instruments of the Brown Instrument Company will be mounted on black metal panels and exhibited at the Chicago Power Show.

Indicating and Recording Pyrometers, Indicating and Recording Flow Meters, Recording Thermometers and Pressure Gauges, Duplex Temperature and Pressure Recorders, Strip Chart Recording Thermometers so sensitive as to operate when the bulb is clasped in the hand, Strip Chart Recording Resistance Thermometer, Brown Electric Carbon Dioxide Meters in operation, Intermediate and Low Range Manometers, Forged Steel Manometers in various stages of construction, Portable Pyrometers and Potentiometers, Draft Gauges, Thermocouples, Protecting Tubes, Automatic Control Valves and Distant Reading Pressure Transmitter, will be included in the exhibit.

Special interest will be found in the large four foot flow meter, showing the mechanism and operation of the inductance bridge principle which will be demonstrated. The wide line of service covered by this exhibit affords the visitor to the Brown Instrument Company's Booth an excellent opportunity to study the use of meters in the modern power plant.

When writing to the above companies mention INSTRUMENTS

Hotwire-Manometer (Das Hitzdrahtmanometer). M. Kundsan, Ann. Phys., Vol. 83, p. 385.

A very sensitive instrument to measure very small pressure changes in the range of 10 to 0.01 mm pressure. The hotwire forms one branch of a bridge arrangement, the current through the hotwire is adjusted to a predetermined value; i^2r is proportional to the pressure.—Ha.

Point by Point Recording of Alternating Current Waves, Particularly of Higher Frequencies. (Ueber punktfoermige Aufnahmen von Wechselstromkurven insbesondere bei hoeherer Frequenz). F. Eisner, Arch. fuer El., Vol. 20, 1928, No. 5/6, p. 473.

Description of a method by means of three electrode tubes to plot point by point curves of frequencies up to 8000 Herz. The upper limit for this method is determined by the capacity of the wiring of this arrangement and lies at about 4×10^5 Herz.—Ha.

Measurement of Three Phase Current in Aron-Connection with Instrument Transformers. (Drehstromleistungsmessung in Aronschaltung mite Messwandler). H. Nuetzelberger and G. Hauffe. Arch. El., Vol. 20, No. 3, 1928, p. 330.

Derivation of the percentage error in the measurement of energy.

On the Measurement of the Distribution of the Electric Field on Insulator Surfaces. (Beitrag zur Messung der Spannungsverteilung auf Isolatoroberflaechen). P. Pulides and A. L. Mueller. El Zschr., Nov. 8, 1928, pp. 1648-1650.

The usual methods of measuring electric field distribution are discussed and compared. A new method is suggested which permits sufficient accuracy in the measurement by means of detector tubes and loudspeaker.

Modern Developments in Aircraft Instruments. Major C. J. Stewart, Proc. Roy. Aero. Soc., June, 1928, pp. 425-481.

The author describes recent British improvements in the field of aircraft instruments. The instruments considered are altimeters, airspeed indicators, statoscopes, climb meters, inclinometers, turn indicators, engine thermometers, pressure gages, tachometers (revolution indicators), fuel flow meters, fuel quantity gages, compasses and drift sights. A discussion of diaphragms and pressure capsules is also included.

The improvements in the performance of the altimeter are notable, the construction of an instrument being described in which the elastic hysteresis has been reduced to 10 feet in a range of 26,000 feet and the effect of temperature reduced to that caused solely by the change in the modulus of elasticity. The discussion of the present status of airspeed indicators, climb meters, tachometers and fuel flow meters is also of especial interest. The illustrations add a great deal to the value of the paper.—W.G.B.

Optical Oscillograph. S. Smith. Astrophys. Jl. Sept. 1928, pp. 165-168.

A beam of light is passed through a nicol prism, a quartz plate, a carbon bisulphide cell and a second nicol. The variable current is carried by a soleniod around the cell. The light is photographed with a rotating mirror spectrograph. Periodic vibrations of the order of 10.6 sec are easily recorded.—Abs. Bull Kodak Res. Labs.

Measurement of Ultra-Violet Quanta by Fluorescence Photometry. W. T. Anderson, Jr. and L. F. Bird. Phys. Rev. Aug. 1928, pp. 293-297.

Using three different fluorescent materials of widely different characteristics (uranium glass, fluorescein, and esculin) the ultra-violet radiation from a quartz mercury arc was passed through a monochrometer and was then converted into visible light of the blue, green, and yellow regions. This visible light was then photometered by the usual inverse square methods. Numerous check readings of the relative intensity of the monochromatic ultra-violet radiation were made with a thermopile. The two methods agree very satisfactorily.—Abs. Bull. Kodak Res. Labs.

Method of Testing Objectives. Y. Vaisola. Rev. d'Opt. Jan. 1, 1928, pp. 44-46.

Various methods applicable particularly to astronomical objectives. Numerical indices for the evaluation of the quality of an objective.—Abs. Bull. Kodak Res. Labs.

Ultra-Microscope with Bilateral Lighting. C. Spierer. Zs. Wiss. Mikroskopie. March 31, 1927, pp. 16-19.

A new microscope using bilateral lighting is described. Work may be done in visible (white) light or using ultra-violet rays. Emphasis is put on (1) the objective, the construction of which is special, and (2) a special condenser whose optical part consists of ground fused quartz, by means of which work in ultra-violet light is made possible. A diagram illustrates the discussion. —Abs. Bull. Kodak Res. Labs.

Measuring the Quality of Sound Reproduction. J. B. Engl. Amer. Cinemat. Oct. 1928, pp. 16-21.

The quality of sound reproduction can be judged by aural appreciation of music, or more accurately by intensity comparisons throughout the frequency range. Two sound generators matched for note and intensity are placed in separate rooms, one with the microphone and the other with the loud speaker. Comparisons between the purity and intensity of the primary and reproduced notes are then possible to an accuracy of about 20% throughout the range.—Abs. Bull. Kodak Res. Labs.

Review of Recent Patents

Printed copies may be obtained at the cost of 10 cents by addressing the Commissioner of Patents, Washington, D. C.

MOTOR METER. William R. Haslewood, Los Angeles, Calif., assignor of one-half to Fred A. Dana, Los Angeles, Calif. Pat. No. 1,685,846.

TEST CLIP. Herbert Huntington, Hartford, Conn., assignor to American Telephone and Telegraph Company. Pat. No. 1,685,847.

INSTRUMENT STRUCTURE. Paul MacGahan, Orange, N. J., assignor to Westinghouse Electric & Mfg. Co. Pat. No. 1,685,951.

MAGNETIC TESTING APPLIANCE AND METHOD OF TESTING. Thomas Spooner, Edgewood Park, Pa., assignor to Westinghouse Electric & Mfg. Co. Pat. No. 1,685,965.

TESTING APPARATUS. Roland B. Alexander and William Howard Rowan, Detroit, Mich. Pat. No. 1,685,973.

AMMETER FRAME. Jesse E. Eshbaugh, Flint, Mich., assignor to A. C. Spark Plug Co. Pat. No. 1,685,992.

TEMPERATURE REGULATOR. Harlan S. Gano, Pittsburgh, Pa., assignor to Westinghouse Electric & Mfg. Co. Pat. No. 1,685,995.

ELECTRICAL MEASURING INSTRUMENT. Henry H. Lyon, Buffalo, N.Y. Pat. No. 1,686,019.

VIBROMETER. Orin E. Marvel, Dayton, Ohio. Pat. No. 1,686,138.

MEASURING INSTRUMENT. Edward H. Bristol, Foxboro, Mass., assignor to The Foxboro Company. Pat. No. 1,686,263.

RECORDING INSTRUMENT. Emil August Ileman, Queens, N. Y., assignor to American Schaefer & Budenberg Corp. Pat. No. 1,686,326.

COAL METER. Jacob M. Spitzglass, Chicago, Ill., assignor to Republic Flow Meter Co. Pat. No. 1,686,351.

OIL-CHANGE RECORDING DEVICE. Francis A. Cook, San Diego, Calif. Pat. No. 1,686,369.

VOLTAGE TESTING APPARATUS. John William Hill, Salt Lake City, Utah, assignor of forty-nine one hundredth to John T. Caley, Salt Lake City, Utah. Pat. No. 1,686,451.

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ELECTRICAL METERING SYSTEM. Raymond T. Pierce, East Pittsburgh, Pa., assignor to Westinghouse Electric & Mfg. Co., Pat. No. 1,687,692.

GYROSCOPIC COMPASS. Harry L. Tamiuer, Brooklyn, N. Y., assignor to The Sperry-Gyroscope Company. Pat. No. 1,687,955.

TEMPERATURE CONTROLLER. Enoch Theander, Brooklyn, N. Y. Pat. No. 1,688,291.

METER FOR MEASURING COMBINED POLY PHASE AND SINGLE-PHASE ELECTRICAL ENERGY. George F. Drewry, Toronto, Ontario, assignor to the Lincoln Meter Co. Pat. No. 1,688,858.

ELECTRICAL MEASURING APPARATUS. Laurice L. Lockrow, Edgewood Borough, Pa., assignor to The Union Switch & Signal Co. Pat. No. 1,688,932.

SEPARABLE-ARM CONSTRUCTION FOR MEASURING INSTRUMENTS. Edgar H. Bristol, Foxboro, Mass., assignor to The Foxboro Company. Pat. No. 1,689,182.

THERMOSTAT. Everett H. White, St. Paul, Minn. Pat. No. 1,689,542.

SPECIFIC GRAVITY INDICATOR. Walter J. Albersheim, New York, N. Y. Pat. No. 1,689,659.

FLOW METER. Clarence A. Dawley, Plainfield, N. J. Pat. No. 1,689,776.

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ELECTRICAL CONTROLLER RECORDER. Chas. H. Wilson and Cuthbert J. Brown, North Pelham, N. Y. Pat. No. 1,690,517.

OPTICAL INSTRUMENT. Adrian P. H. Trivelli, Rochester, N. Y., assignor to Eastman Kodak Company. Pat. No. 1,690,602.

TESTING DEVICE. William H. Tarver, Pooler, Ga. Pat. No. 1,690,653.

MOISTURE INDICATING INSTRUMENT FOR WOOD. Matthew Eldridge Dunlap, Madison, Wis., assignor to the Government and the People of the United States of America. Pat. No. 1,690,672.

New Developments in Aerial Photography. C. B. Neblette. Photo-Era, Oct. 1928, p. 228.

A brief description of a new aerial camera. It is electrically heated and especially adapted for use at distances above five miles from the earth's surface. The camera, four feet in height, contains film for 100 exposures and gives a picture 9 by 18 inches. A sextant camera has been developed. It will be used by Byrd on his Antarctic expedition and will record the position of the camera at the moment of exposure, the time of exposure, and the tilt of the airplane.—Abs. Bull. Kodak Res. Labs.

Universal Apparatus for Photomicrography. Zs. wiss. Mikroskopie. March 31, 1927, pp. 42-46.

The author discusses photomicrographic cameras put out by three German companies. His micro-camera (produced by the Zeiss-Winkel-Gottingen firm) combines the advantages of the others. By means of the "Universal Apparatus," photomicrographs may be taken in horizontal position; in vertical position in transmitted light; in incident light, using an illuminator. Illustrations are given.—Abs. Bull. Kodak Res. Labs.

Apparatus for the Determination of Viscosity under different conditions, and the Errors induced by changes of velocity of the moving liquid, surface tension, and displacement caused by air. E. Masters and A. E. Goddard. Ber. Chem. March 7, 1928, pp. 586-591.

The authors describe an apparatus for the determination of comparative and relative viscosities. It is best adapted for Scarpa's method whereby errors caused by air displacement, surface tension, and necessity of determining density and mean height of liquid column are eliminated. The authors claim the following advantages: (1) Bulb and capillary easily cleaned; (2) length of capillary can be determined very accurately; (3) small vessels and hence small amounts of material are used; (4) no correction for kinetic energy is necessary.—Abs. Bull. Kodak Res. Labs.

Photography in Science. I. W. D. Hackh. Camera Craft. Aug. 1928, pp. 361-365; Oct. 1928, pp. 475-479.

As examples of the use of photography for scientific recording, a description is given of the factograph, the photomanometer, the photogalvanograph.—Abs. Bull. Kodak Res. Labs.

Application of a Valve Amplifier to the Measurement of X-Ray and Photo-Electric Effects. C. E. Wynn-Williams. Phil. Mag. Aug. 1928, pp. 324-334.

Two valve amplifiers connected as a bridge may be used to replace an electrometer in the measurement of small ionization currents. By a new arrangement the device may be used even in the presence of induction coils or high voltage apparatus, making it particularly attractive for work on ionization by X-rays.—Abs. Bull. Kodak Res. Labs.

Varied Uses of the X-Ray. Camera. Oct. 1928, pp. 224-226.

Among the many uses for X-rays are methods of testing of flaws in castings, and in forgings and plates in automobile and airplane parts; the detection of imitation gems, of flaws in abrasive wheels, in shells, in fuses, in crockery, in china; and testing the authenticity of paintings.—Abs. Bull. Kodak Res. Labs.

Photomicrography in the Leather Industry. C. B. Neblette. Photo-Era. Oct. 1928, pp. 222-224.

To illustrate the value of photography to the leather industry, photomicrographs accompanied by a brief description are shown.—Abs. Bull. Kodak Res. Labs.

Use of Motion Pictures for Recording Stress Patterns by Means of Polarized Light. R. Thun. Kinotechnik. Sept. 20, 1928, pp. 483.

Motion picture methods are applied to the study of stress patterns by means of polarized light. The light source is polarized by the use of 20 glass plates at an angle of 52° to the incident light so that a field 3 by 4 cm. is illuminated. A nicol prism is used as an analyzer in front of the camera objective. Studies were made of imperfections in glass and cellulose nitrate.—Abs. Bull. Kodak Res. Labs.

Automatic Control of the Carbonation Process in Beet-Sugar Manufacture. R. T. Balch and J. C. Keane. Ind. Engg. Chem. Nov. 1928, pp. 1148-1151.

The control functions on electrometric principles whereby the e.m.f. produced between the tungsten and calomel electrodes immersed in the juice, which varies in proportion to the pH of the juice, causes the electric motor that is connected to the gas valve to operate through a system of relays.—M.E.H.

Automatic Control Through Temperature or Pressure. C. J. Swan. Ind. Engg. Chem. Nov. 1928, pp. 1152-1155.

An outstanding feature of this method of control is the design of the electric switch which makes and breaks contact depending upon changes in temperature or pressure.—M.E.H.

Measurement of the Size of Crystalline Particles by means of X-rays. A. L. Patterson. Z. Kristallographie, March, 1928, pp. 637-650.

Formal mathematical treatment is given of von Laue's theory of X-ray diffraction by crystal lattices. The theory is extended to the cases in which the crystalline particles are of different sizes; the cases of a Maxwell distribution and a general distribution of particle sizes are considered. The average particle size cannot be determined by measuring the width of the interference ring in a Debye-Scherrer diffraction pattern because this depends upon the (here unknown) distribution of particle sizes. The irregularities in crystal latices in size and form also influence the width of the interference ring. In the study of colloidal particles the variation in size may cause several orders of reflection to overlap and produce only one broad ring instead of three or five rings among which the narrow central ring has the sought-for width. Thus the particle size cannot be determined for substances having an uncertain structure.—Abs. Bull. Kodak Res. Labs.

DEVICE FOR INDICATING DENSITY OF LIQUIDS. Frank Schwartz, New York, N. Y. Pat. No. 1,691,084.

INDOOR-OUTDOOR THERMOMETER. Herman Schlaich, Long Island City, N. Y. Pat. No. 1,691,136.

MEANS FOR MEASURING TEMPERATURE. Howard D. Matthews, Mansfield, Ohio, assignor to Westinghouse Electric & Mfg. Co. Pat. No. 1,691,247.

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IMPULSE TESTING EQUIPMENT. Martin L. Nelson, Park Ridge, Ill. Pat. No. 1,693,725.

METHOD AND APPARATUS FOR LOCATING THE POINT OF ESCAPE OF A FLUID FROM CONCEALED PIPES. William B. Weldon, Chicago, Ill. Pat. No. 1,693,737.

REGISTERING APPARATUS. Claude Worth Martin, Gold Hill, Ore. Pat. No. 1,693,763.

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CAN-TESTING MACHINE. Charles D. McDonald, Chicago, Ill. Pat. No. 1,694,132.

METHOD AND APPARATUS FOR SETTING THERMOSTATS. David N. Crosthwait, Jr., Marshalltown, Iowa. Pat. No. 1,694,164.

TEMPERATURE CONTROLLING APPARATUS FOR INTERNAL COMBUSTION ENGINES. Frederick M. Furber, Revere, Mass. Pat. No. 1,694,171.

GYROSCOPIC COMPASS. Elmer A. Sperry, Brooklyn, N. Y. Pat. No. 1,694,192.

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The Use of Switch Board Instruments for the Measurement of Various Quantities. (Verwendung von Schalttafelmessgeraeten zur Messung verschiedenartiger Groessen.) W. Fuhrmann. Messtechnik. Nov. 22, 1928, pp. 296-301.

This article takes up the use of an ammeter with an apparent output scale, output meter with apparent output scale, power factor measurement with such double scale instruments, watt-hour meters for the simultaneous measurement of work and power, current or voltage.

Electric Measurement (Elektrisches Messen) Dr. Bubert. Messtechnik. Nov. 22, 1928, pp. 301-303.

This article takes up electric measuring instruments and measuring methods, instrument for the electrical measurement of non-electrical quantities, and electrical distance recorders.

The Mechanical Testing of Materials. R. W. Bailey. Proc. Inst. Mech. Engrs. May 1928, pp. 417-452.

The plant testing of metals employed in construction of high-speed machinery is taken up.

Measurement of Steam Quantity in Works Practice. J. L. Hodgson. Jl. of Inst. of Fuel. Oct. 1928, pp. 17-32.

The paper describes the construction and installation of several forms of steam meter, the precautions to be taken in their use, and the computation from their readings of the total steam used over a given period.

The Standardization of Laboratory Apparatus. (Normung der Laboratoriums-Geraete.) Gl. Appar. Dec. 16, 1928, pp. 243-245.

The specification for thermometers and precision measuring flasks is given.

The Development of Current Transformers for High Voltage. (Die Entwicklung der Stromwandler fuer Hochspannung.) G. Keinath. Messtechnik. Nov. 22, 1928, pp. 287-292.

This article considers the development of current transformers, their measuring accuracy and type.

The Ferraris Movement as a time measuring instrument. (Das Ferraris-Laufwerk als Zeitmesser.) Dr. Kesseldorfer. Messtechnik. Nov. 22, 1928, pp. 292-295.

The construction and operation of a simple Ferraris movement is considered. The dependence of the revolution upon the voltage, frequency and temperature variations is also shown.

The extensometer described gives a load-extension diagram of single ultimate filaments of silk. Tensions on the filament under test produce torsion on a steel blade; these are recorded by the consequent deflections in a vertical plane of a beam of light which falls on a photographic film.

The Errors Associated with High Resistance in Alternating Current Measurements. R. Davis. Jl. Sci. Insts. Nov. 1928, pp. 354.

Continued from page 312. Mathematical consideration.

On the Measurement of High Temperatures. (Ueber Messung hoher Temperature.) L. Arends. Zs. Feinmech. Dec. 29, 1928, pp. 1-3.

The use of the radiation and optical pyrometers are briefly considered.

Optical Arrangements of the Half-Shadow Polarisation Apparatus. (Optische Einrichtungen der Halbschatten-Polarisationsapparate.) Zs. Feinmechanik. Nov. 13, 1928, pp. 5-7.

The information contained in this article is taken from the catalogue of Franz Schmidt & Haensch.

Method for using the Engler Viscosimeter. (Ueber die Handhabung des Englerchen zaehigkeitsmessers.) S. Erk. Gl. Appar. Dec. 30, 1928, pp. 253-254.

The method of operation is briefly discussed.

Ultra-Violet Microscopy. L. Martin and B. Johnson. Jl. Sci. Insts. Nov. 1928, pp. 337-344.

This paper describes experience encountered in trials of various methods of ultra violet microscopy. The selection with the aid of the interferometer of the fused quartz for the objective; the arrangement of the illuminating systems; old and new methods of finding the ultra-violet focus; the mechanical requirements of the microscope; the control of the immersion fluid by the use of non-hygroscopic mixtures, and the investigation of the resolving power of ultra violet systems are discussed. (cont'd)

The Pilot Balloon Slide Rule. F. Whipple. Jl. Sci. Insts. Nov. 1928, pp. 345-348.

The special features of the rule are described.

Testing Instruments for Yarns and Fibres. W. Denham and T. Lonsdale. Jl. Sci. Insts. Nov. 1928, p. 348.

A ballastic instrument for measuring the work done in breaking a thread or bundle of filaments is described. The thread is mounted between two clamps, one of which is incorporated into a pendulum at its center of percussion, the other rests on a ledge on the pendulum, the instrument being contrived so that this clamp is cut on fixed projections when the pendulum is at the lowest part of its swing. The energy absorbed in breaking a thread is measured in terms of consequent decrease of the arc of swing of the pendulum after falling from a definite height.

A Simple Gold Leaf Electrometer for High-Frequency Measurements. S. Ray.

INDICATING DEVICES. Ralph E. Booth, Lynn, Mass. Pat. No. 1,694,307.

SPEED CONTROL SYSTEM. John I. Hull, Schenectady, N. Y. Pat. No. 1,694,322.

JOURNAL LENGTH GAUGE. Ward N. Messimer, Jersey Shore, Pa. Pat. No. 1,694,333.

APPARATUS FOR CONTROLLING THE DRYING OPERATION IN PAPER MACHINES. George E. Witham, Jr., Hudson Falls, N. Y. Pat. No. 1,694,349.

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GYROSCOPIC COMPASSES. Sperry Gyroscope Co., Brooklyn, N. Y. Pat. No. 290,670.

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A Simple Gold Leaf Electrometer for High-Frequency Measurements. S. Ray. Proc. Phys. Soc. Lond. Aug. 15, 1928, pp. 307-311.

A gold-leaf electrometer of the attraction type has been designed to supply the need for a simple instrument that can be used to measure voltages down to a few volts in high-frequency circuits, and which permits of precise indications of exact resonance in a simple circuit containing inductance and capacity.

The instrument will detect voltages as low as 4 volts and has a low capacity. It also possesses the advantages of quick response and negligible power consumption.

The Petrographic Microscope as an Instrument for the Glass Technologist. H. Insley. Jl. Amer. Cer. Soc. Nov. 1928, pp. 812-828.

The value of the Petrographic microscope to the glass technologist in identifying crystalline defects in glass and impurities in raw materials is pointed out. The behavior of light in passing through crystalline materials and methods of manipulation of the petrographic microscope in the identification of crystalline compounds in glass and glass making materials are briefly described.

Tests of the Fatigue Strength of Steam Turbine Blade Shapes. H. F. Moore, S. Lyon and N. Alleman. Bull. 183. Engg. Exp. Sta. Univ. of Ill.

The tests reported in this report constitute a study of the strength of steam turbine blade shapes of several different metals to resist many cycles of reversed bending stress.

The Measurement of Air Quantities and Energy Losses in Mine Entries. Part III. A. Callen and C. Smith. Bull. 184. Engg. Exp. Sta. Univ. of Ill.

This report is a continuation of previous work reported in Bulletins 158 and 170.

A Study of the Failure of Concrete under Combined Compressive Stresses. F. Richart, A. Brandtzaeg and R. Brown. Bull. 185. Engg. Exp. Sta. Univ. of Ill.

This paper contains a study of concrete specimens loaded in compression in one, two, or in three directions at right angles to each other by means of fluid pressures.

The Surface Tension of Molten Metals, Part II, A Determination of the Capillary Constant of Silver. E. Libman. Bull. 187, Engg. Exp. Sta., Univ. of Ill.

This bulletin deals with the determination of the capillary constant of silver.

U. S. Standard Atmosphere Tables and Data. Walter S. Diehl. N. A. C. A. Tech. Report No. 218, 1926.

Tables for Calibrating Altimeters and Computing Altitudes Based on the Standard Atmosphere. W. G. Brombacher. N. A. C. A. Tech. Report No. 246, 1926.

These two old reports are called to the attention of our readers because of their usefulness for reference purposes. Data is given on the standard atmosphere officially adopted and in use by all of the government aeronautic organizations.—W.G.B.

The Variation in Pressures in the Cockpit of an Airplane in Flight. T. Carroll and W. H. McAvoy. Nat. Adv. Com. Aero. Tech. Note No. 300, 1928 (Secured on application).—W.G.B.

The Measurement of Maximum Cylinder Pressures. Chester W. Hicks. Nat. Adv. Com. Aero. Tech. Report No. 294, 1928.

Includes a description of the apparatus and instruments developed to measure the maximum pressures occurring in aircraft engine cylinders.—W.G.B.

The Measurement of Gas Temperatures up to 1500°C in Radiation Fields of Changing Anisotropy. (Die Messung von Gastemperaturen bis 1500° in Strahlungsfeldern wechselnder Anisotropi.) H. Schmidt. Archiv fuer Eisenhuettenwesen. Nov. 1928, pp. 293-299.

This article contains additional information on gas temperature measurement; extension of the measuring range up to 1500°; the measurement of radiation on the thermocouple by hot walls; improvement of the construction of earlier gas pyrometers and the measurement of gas and air temperatures in the checkers of an open-hearth furnace.

Abstract of the above is also contained in S. u. E. Dec. 27, 1928, pp. 1825-1826.

Advances in Aerotriangulation. (Fortschritte der Aerotriangulation.) O. V. Gruber. Bild. u. Lieftbeld. Dec. 1928, pp. 141-150.

This article considers the progress in aerotriangulation.

A Dilatometer—Catalysis in the Hydration of Acetic Anhydride. Martin Kilpatrick, Jr. Jl. Amer. Chem. Soc. Nov. 1928, p. 2893.

The dilatometer was designed specially for taking care of the heat of reaction, which appears often to have been overlooked in the dilatometer method.—M.E.H.

Mass-Spectrograph—Radium and Geology. Charles S. Piggot, Jl. Amer. Chem. Soc. Nov. 1928, pp. 2910-2916.

A direct experimental means of determining the uranium and uranium-derived lead involved in an age determination by the use of the mass spectrograph is given.—M.E.H.

A Modified McLeod Gage—Three Laboratory Devices. A Vacuum Stirrer, A Pressure Alternator and a Gage for Measuring Low Pressures or Permanent Gases in Condensable Vapors. Roger K. Taylor. Jl. Amer. Chem. Soc. Nov. 1928, p. 2939.

A McLeod gage, slightly modified according to diagram given, may be employed to detect the partial pressure of small amounts of permanent gases in a condensable vapor.—M.E.H.

COLORIMETRIC TESTING. R. L. Rees, Middlesex, England. Pat. No. 291,174.
THERMOSTATS. H. J. Yates, London, Eng. Pat. No. 291,223.
THERMOMETERS. P. L. Marks, London, Eng. Pat. No. 291,311.
ELLIPSOGRAPHS. J. Guenther & J. Saupe, Leipzig, Germany. Pat. No. 291,324.
WEIGHING AND COMPUTING APPARATUS. L. Gandriant, Nancy, France. Pat. No. 291,369.
COLORIMETERS, PHOTOMETRIC APPARATUS. A. C. Hardy and F. W. Cunningham, Wellesley, Mass. Pat. No. 291,397.
DEPTH SOUNDING LEADS. Electro-acustic Ges. Kiel, Germany. Pat. No. 291,444.
RECORDING RATE & DIRECTION OF FLOW. J. M. P. Idrac, Paris, France. Pat. No. 291,447.
WEIGHING APPARATUS. H. J. Wollaston, Lowestoft, Eng. Pat. No. 291,488.
GAS METERS. S. Simpson, Devon, England. Pat. No. 291,055.
LIQUID LEVEL INDICATORS. A. W. Bullen, Middlesex, Eng. Pat. No. 291,513.
MICROSCOPES. W. Watson & Sons, London, Eng. Pat. No. 291,598.
THERMOSTATS. W. A. Van Berkel, Rotterdam, Holland. Pat. No. 291,669.
GAUGE GLASSES. M. W. Holfert, Reechenberg, Czecho-Slovakia. Pat. No. 291,676.
ELECTRIC MEASUREMENTS. Electroflo Meters Co., London, Eng. Pat. No. 291,681.
MILK MEASURING MACHINES. E. Prestage, London, Eng. Pat. No. 291,682.
DELIVERING MEASURED QUANTITIES OF LIQUID. T. Tella, Buenos Aires, Argentina. Pat. No. 291,710.
ELECTRIC MEASUREMENTS. British Thomson-Houston Co., Ltd., London, Eng. Pat. No. 291,731.
FLUID PRESSURE REGULATORS. Canada Sugar Refining Co., Montreal, Canada. Pat. No. 291,764.
STROBOSCOPIC APPARATUS. Osaka, Japan. Pat. No. 291,791.
WEIGHING APPARATUS. Maat Schappij tot Vervaardiging, Rotterdam, Holland. Pat. No. 291,801.
WEIGHING APPARATUS. T. S. Murray, London, Eng. Pat. No. 291,895.
ELECTRIC MEASUREMENTS. E. Ellis, Chester, Eng. Pat. No. 291,907.
AUTOMATIC REGULATORS. B. R. & B. T. Wingfield, Middlesex, Eng. Pat. No. 291,923.
PYROMETERS. D. C. Gall, Surrey, Eng. Pat. No. 291,971.
THERMOMETERS. E. C. R. Marks, London, Eng. Pat. No. 292,018.
GAS ANALYSIS. A. Olsson and P. D. Peterson, Lidkoping, Sweden. Pat. No. 292,083.
RECORDING APPARATUS. International General Electric Co., New York, N. Y. Pat. No. 292,148.
SPEEDOMETERS. G. Mombur, Versailles, France. Pat. No. 292,156.
ELECTRICMETERS. Telefonaktiebolaget, L. M. Ericsson, Stockholm, Sweden. Pat. No. 292,166.
ELECTRICAL MEASUREMENTS. International General Electric Co., New York, N. Y. Pat. No. 292,173.
RECORDING APPARATUS. Automatic Telephone Mfg. Co., Liverpool, Eng. Pat. No. 292,225.
DELIVERING LIQUIDS IN MEASURED QUANTITIES. J. Fraser, London, Eng. Pat. No. 292,238.
WEIGHING APPARATUS. H. Simon, Ltd., and J. C. Brian, Manchester, Eng. Pat. No. 292,252.
ELECTRIC MEASUREMENTS. A. R. Van Den Bergh, Hampshire, Eng. Pat. No. 292,254.
PRESSURE INDICATORS FOR INTERNAL COMBUSTION ENGINES. L. Pendred and R. Abraham, London, Eng. Pat. No. 292,280.
MEASURING TURBIDITY, COLOUR, ETC., OF FLUIDS. W. G. Exton, New York, N. Y. Pat. No. 292,337.
WATER INDICATORS FOR MOTOR RADIATORS. C. L. Breeden, Birmingham, Eng. Pat. No. 292,383.
ELECTRIC MEASURING INSTRUMENTS. Langbein-Pfanhauser Werke, A. G. Leipsic, Germany. Pat. No. 292,417.
ELECTRIC MEASUREMENTS. Siemens & Halske, A. G., Berlin, Germany. Pat. No. 292,454.
MAGNETIC COMPASSES. E. Vion, Paris, France. Pat. No. 292,489.
SPEEDOMETERS. A. C. Spark Plug Co., Flint, Mich. Pat. No. 292,499.
DYNAMOMETERS. T. Takahashi, Osaka, Japan. Pat. No. 292,516.
WEIGHING APPARATUS. Maatschappij tot Vervaardiging, Rotterdam, Holland. Pat. No. 292,517.
ELECTRIC METERS. Landis & Gyr, Zug, Switzerland. Pat. No. 292,550.
ELECTRIC MEASUREMENTS. Siemens & Halske, A. G., Berlin, Germany. Pat. No. 292,579.
GAS ANALYSIS. Electrolux, Ltd., London, Eng. Pat. No. 292,607.
RECORDING APPARATUS. Work Meters, Ltd., Westminster, Eng. Pat. No. 292,640.
WEIGHING APPARATUS. W. Molins, London, Eng. Pat. No. 292,699.
DELIVERING REAGENTS IN MEASURING QUANTITIES. A. S. Legg, Surrey, England. Pat. No. 292,713.
THERMOMETERS. Siemens Bros. & Co., Westminster, Eng. Pat. No. 292,773.
RAIN GAUGES. W. Rollason, London, Eng. Pat. No. 292,776.
GAS METERS. Metropolitan Gas Meters, Ltd., Nottingham, Eng. Pat. No. 292,780.
MICROSCOPES. C. Beck, London, Eng. Pat. No. 292,784.
MEASURING MECHANICAL EQUIVALENT OF HEAT. W. D. Hills, Kent, Eng. Pat. No. 292,807.
WEIGHING APPARATUS. Oertling, Ltd., London, Eng. Pat. No. 292,820.
DIFFERENTIAL PRESSURE GAUGES. R. Bosselmann, Berlin, Germany. Pat. No. 292,859.
WEIGHING APPARATUS. S. Toth, Szeged, Hungary. Pat. No. 292,934.
TURBIDOMETERS. M. Buchholz., Cassel, Germany. Pat. No. 293,034.
DELIVERING MEASURED QUANTITIES OF LIQUID. Fabrik Explosionssicherer Gefaesse Salzkotten Ges, Berlin, Germany. Pat. No. 293,036.
GAS ANALYSIS. H. T. Rengrose, Newark-on-Trent, Eng. Pat. No. 293,125.
WEIGHING APPARATUS. W. & T. Avery, Birmingham, Eng. Pat. No. 293,153.
CLINOMETERS. A. S. Aegerter, Dresden, Germany. Pat. No. 293,156.

Tests for Tin Coated Wire. J. D. Brunton. Wire & Wire Products. Dec. 1928, pp. 406-407.

This article covers simple laboratory tests for detecting imperfections in wire coated with tin.

Ball Impression Tests for Torsion Numbers and Tensile Strength. Dr. B. Garre. Wire & Wire Products. Jan. 1929, pp. 8-10.

This article gives results of tests on wire. These show a constant relation between the drawing limit and degree of hardness. This article is translated from Centralblatt der Huetten und Walzwerke.

Strainmeter Tests of a Railway Bridge. H. R. Garth.

Paper read before the Institution of Civil Engineers. Brief particulars of strainmeter tests of railway bridges of various types are given.

The Properties of Breeze and Clinker Aggregates and Methods of Testing Their Soundness. Bull. No. 5, Dept. Scientific & Industrial Research.

This bulletin presents a survey of the causes of failure of concrete made with these materials. Two methods of testing the soundness of breeze and clinker aggregates are given.

Effect of "Nip" on the Mechanical Properties of Laminated Springs. Special Rep. No. 11, Dept. Scientific & Industrial Res.

The results of the tests are described in detail and particulars are given of the apparatus and methods employed.

An Extensometer and Compressometer of the Hydro-Static Type. H. H. Langdon, Engg. Bull. 25, Expt. Sta., State College of Wash., Pullman, Wash.

The instrument developed by the Engg. Expt. Sta. is described and illustrated.

On the Geometric Design of Scientific Instruments. J. A. Tomkins. Instrument World. Dec. 1928, pp. 229-231.

The design is considered theoretically.

A New Photometer. John F. Sutton, Instrument World. Dec. 1928, pp. 233-234.

A photometer sold by Baird & Tatlock is briefly described.

The Mariner's Astrolabe. R. T. Gunther. Instrument World. Dec. 1928, pp. 241-242.

Abridgement of a paper read before the Royal Geographical Society. The article briefly mentions some astrolabes of historical value. This instrument was used from the fifteenth to the seventeenth centuries for the determination of latitude.

Development of the Impedance Bridge. S. J. Zammataro. Bell Labs. Rec. Dec. 1928, pp. 150-154.

The historic development of bridges for electrical measurements is briefly given.

Locating Faults on Toll Lines. A. J. Pascarella. Bell Labs. Rec. Dec. 1928, pp. 161-164.

Methods for locating faults are briefly described.

On the Photomicrography and Metallography of Graphite Flakes. A. L. Norbury & L. W. Bolton. Bull. Brit. C. I. Res. Ass. Oct. 1928, pp. 52-54.

This article considers the effect of variations in methods of polishing and photographing on the apparent size of graphite flakes. The impurities in graphite flakes is also considered.

High-Speed Practice for Indicating Diesel Engines. Rudolf Ulrich. Oil Engine Power. Dec. 1928.

The correct procedure for taken indicator cards is given. The use of the reducing motion is considered. The results given in the article apply to the Maihak Indicator No. 4.

A New Method for Measuring Osmotic Pressure. R. V. Townend. Jl. Amer. Chem. Soc. Nov. 1928, pp. 2958-2966.

A new method for measuring osmotic pressure is described which can be applied to dilute solutions of any non-volatile solute in a volatile solvent. The vapor phase serves as a diaphragm. —M.E.H.

Vapor Pressures in Small Capillaries—A Study of Vapor Pressures in Small Capillaries. Part I. Water Vapor. (a) Soft Glass Capillaries. J. L. Shereshefsky. Jl. Amer. Chem. Soc. Nov. 1928, pp. 2966-2980.

A method is described for measuring vapor pressures of liquids in small capillaries. Apparatus diagram is shown.

A Study of Vapor Pressures in Small Capillaries. Part II. J. L. Shereshefsky. Jl. Amer. Chem. Soc., Nov. 1928, pp. 2980-2985.

This describes modification of the apparatus used in the preceding article.—M.E.H.

Calorimeter—An Application of the Rule of Dulong and Petit to Molecules. D. H. Andrews and Ellis Haworth. Jl. Amer. Chem. Soc. Nov. 1928, pp. 2998-3002.

The measurements of heat capacity were made in a calorimeter which operates on the principle of calibrated heat conduction, described in Jl. Amer. Chem. Soc., 48, 127 (1926). Some improvements on this calorimeter are given.—M.E.H.

The Recording Spectrophotometer for Precise Color Analysis. G. E. Rev. Dec. 1928, pp. 684-685.

The construction of the instrument is given.

A System for Measuring Tapers. Amer. Mach. Dec. 13, 1928, pp. 907-911.

A system of measuring tapers, which was designed for cartridge and gun chamber gages is given.

DELIVERING LIQUIDS IN MEASURED VOLUMES. J. E. Heilmann Skelskoer, Denmark. Pat. No. 293,235.

INDICATING LIQUID LEVEL. H. Hobson, Ltd., London, Eng. Pat. No. 293,251.

THERMOMETERS. A. C. Spark Plug Co., Flint, Mich., Pat. No. 293,320.

SOUND MEASURING DEVICES. F. W. Highfield Electrical Co., Coventry, Eng. Pat. No. 293,337.

DELIVERING LIQUIDS IN MEASURED VOLUMES. A. C. Scott, Kent, Eng. Pat. No. 293,338.

WEIGHING APPARATUS. L. Gandriant, Nancy, France. Pat. No. 293,348.

ELECTRIC TESTS. West Mfg. Co., Chicago, Ill. Pat. No. 293,378.

ELECTRIC METERS. Landis & Gyr, Zug, Switzerland. Pat. No. 293,386.

ELECTRIC MEASUREMENTS. Siemens Schuckertwerke, A. G., Berlin, Germany. Pat. No. 293,387.

ELECTRIC MEASUREMENTS. H. Butler, Warwickshire, Eng. Pat. No. 293,402.

WEIGHING APPARATUS. O. B. Foerster, Nuremberg, Germany. Pat. No. 293,445.

SPEEDOMETERS. A. Kreidler, Stuttgart, Germany. Pat. No. 293,467.

THERMOMETERS. Scientific & Projections, London, Eng. Pat. No. 293,547.

RECORDING APPARATUS. H. R. Cool, Cleveland, Ohio. Pat. No. 293,640.

SPEEDOMETERS. A. Stoppani, Berne, Switzerland. Pat. No. 293,689.

MAGNETIC COMPASSES. Soc. des Etablessements Aera, Paris, France. Pat. No. 293,798.

INDICATING LIQUID LEVELS. Soc. des Accumulateurs Electriques Anciens Etab., Seine, France. Pat. No. 293,825.

ELECTRIC TESTS. Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium. Pat. No. 293,831.

GAS METERS. A. Lutz, Stuttgart, Germany. Pat. No. 293,836.

ELECTRIC MEASUREMENTS. A. C. Spark Plug Co., Flint, Mich. Pat. No. 293,842.

ELECTRIC METERS. Metropolitan-Vickers Co., Westminster, Eng. Pat. No. 293,830.

PRESSURE INDICATORS. B. Hocken, Cornwall, Eng. Pat. No. 293,902.

WEIGHING APPARATUS. F. Dehn, London, Eng. Pat. No. 293,928.

THERMOSTATS. G. G. Royer, Paris, France. Pat. No. 293,930.

WEIGHING APPARATUS. W. & T. Avery, Birmingham, Eng. Pat. No. 293,963 & 293,964.

WEIGHING APPARATUS. G. Hutchinson, Sheboygan, Wis. Pat. No. 293,983.

ELECTRIC MEASUREMENTS. A. Campbell, Cambridge, Eng. Pat. No. 294,053.

ELECTRIC MEASUREMENTS. Metropolitan-Vickers Electrical Co., Westminster, Eng. Pat. No. 294,115.

CLOCKS. Magnetic Swisse Soc. Anon, Zug, Switzerland. Pat. No. 294,165.

RECORDING APPARATUS. H. R. Cool, Cleveland, Ohio. Pat. No. 294,189.

LIQUID-LEVEL INDICATORS. E. Seignol, Paris, France. Pat. No. 294,223.

WEIGHING APPARATUS. L. Gendriant, Nancy, France. Pat. No. 294,229.

ELECTRIC MEASUREMENTS. British Thomson-Houston Co., London, Eng. Pat. No. 294,241.

WEIGHING APPARATUS. D. Lowe & J. Wheeler, Midlothian, Eng. Pat. No. 294,302.

RECORDING FLOW OF LIQUIDS. G. Barraclough, Bradford, Eng. Pat. No. 294,340.

LEVELING HEADS FOR SURVEYING INSTRUMENTS. E. Marks, London, Eng. Pat. No. 294,456.

DELIVERING MEASURED VOLUMES OF LIQUID. Naamlooze Ven Nootschap Mattschappij Voor Uitvindingen Van Dikkers en Bargeboer, Hague, Belgium. Pat. No. 294,631.

ELECTRIC METERS. British Thomson-Houston Co., Ltd., London, Eng. Pat. No. 294,642.

ELECTRIC METERS. International General Electric Co., New York, N. Y. Pat. No. 294,666.

GYROSCOPIC APPARATUS. P. Schilovsky, London, Eng. Pat. No. 294,691.

ELECTRIC MEASUREMENTS. E. Moullin, Cambridge, Eng. Pat. No. 294,792.

INDICATING AND RECORDING APPARATUS. Electroflo Meters Co., London, Eng. Pat. No. 294,812.

ELECTRIC MEASUREMENTS. G. Shotter, Middlesex, Eng. Pat. No. 294,831.

ELECTRIC MEASUREMENTS. C. Lipman, London, Eng. Pat. No. 294,919.

WEIRS. Maschinenfabrik Augsburg-Nuernberg, A. G., Nuernberg, Germany. Pat. No. 294,954.

ELECTRIC MEASUREMENTS. Siemens & Halske, A. G., Berlin, Germany. Pat. No. 294,976.

WEIRS. Maschinenfabrik Augsbung-Nuremberg, A. G., Nuremberg, Germany. Pat. No. 294,954.

ELECTRIC MEASUREMENTS. Siemens & Halske A. G., Berlin, Germany. Pat. No. 294,976.

DELIVERING MEASURED QUANTITIES OF LIQUIDS. J. Livesey, Manchester, Eng. Pat. No. 295,061.

SPEEDOMETERS. E. Marks, London, Eng. Pat. No. 295,063.

GAS METERS. Kirkewhite Engg. Co., Nottingham, Eng. Pat. No. 295,105.

INDICATING INSTRUMENTS. J. G. Paulin, Stockholm, Sweden. Pat. No. 295,160.

INDICATING ACCELERATIONS. W. Tapley, Hampshire, Eng. Pat. No. 295,174.

MEASURING FLUID PRESSURE. Soc. Anon. Union Technique du Batiment et des Travaux Publics, Paris, France. Pat. No. 295,256.

INDICATING LIQUID LEVELS. L. Murphy, Dublin, Ireland. Pat. No. 295,305.

ELECTRIC MEASUREMENTS. E. Norinder, Uppsola, Sweden. Pat. No. 295,321.

DELIVERING MEASURED QUANTITIES OF LIQUIDS. T. Rogers and Moorhause & Co., Cheshire, Eng. Pat. No. 295,341.

ELECTRIC METERS. Siemens-Schuckertwerke, A. G., Berlin, Germany. Pat. No. 295,389.

WEIGHING APPARATUS. W. & T. Avery, Birmingham, Eng. Pat. No. 295,432.

WEIGHING APPARATUS. Maatschappij tot Vervaardigang Van Snijmachines Volgens, Rotterdam, Holland. Pat. No. 295,460.

DELIVERING LIQUIDS BY MEASURE. F. Wood, Sussex, Eng. Pat. No. 295,462.

Boiler Room Records Spot Losses in the Industrial Power Plant. H. W. Morgan. Power. Dec. 18, 1928, pp. 997-998.

The keeping of boiler room records is discussed.

Selecting Controllers for Alternating-Current Motors. W. H. Costello. Power. Jan. 8, 1929, pp. 52-54.

The types of controllers for alternating current motors are listed and described.

Automatic Control Improves Product and Lowers Cost. H. S. Sturtevant. Power. Jan. 8, 1929, pp. 57-58.

The use of instruments for operation control at the Hartford Rubber Works Company is described.

Effect of CO_2 on Plant Economy. B. C. Sprague. Power. Jan. 8, 1929, pp. 62.

The effect of CO_2 on plant efficiency is discussed.

Meters and Instruments in Pulp and Paper Mills. R. V. Knapp. Paper Tr. Jl. Nov. 22, 1928, pp. 61-65.

The article points out the need for meters and instruments in paper and pulp manufacture. The various instruments, which the author feels should be used, and the points at which they should be installed are discussed.

Strength Testing of Chemical Pulp. G. Hall & W. Woodson, Jr. Paper Tr. Jl. Jan. 24, 1929, pp. 51-55.

This article gives a comparison of beating tests with the Abbe pebble mill and a new metal ball mill.

The Throttling Calorimeter and its Use. M. D. Smith, Southern Power Journal. Jan. 1929, pp. 53-54.

The construction of the instrument is given and formulae for the necessary calculations are illustrated.

Stroboscope—with Special Reference to the Ashdown Rotoscope. Instrument World. Jan. 1929, pp. 271-276.

The elementary principle is illustrated and the Ashdown Rotoscope is taken up in some detail.—M.B.R.

The Influence of Boundary Contrast on the Accuracy of Physical Measurement. Abstracted from the Physikalische Zeitschrift of January 1928. Instrument World. Jan. 1929, pp. 261-263.

The vapor gives a comprehensive survey of a problem of great importance to the astronomer and the physicist.—M.B.R.

The Modern Reflecting Telescope and the New Astronomical Photography. G. W. Ritchey. Trans. Opt. Soc. 1927-28, No. 5, pp. 197-224.

The new types of reflecting telescopes are illustrated and described.

Note on the Use of Lenses in Series for Sight Testing. T. Smith. Trans. Opt. Soc. 1927-28, No. 5, pp. 243-250.

The paper deals with the theory of a train of lenses placed in series as used in a trial frame or other instrument. The series arrangement enables a small number of lenses to be combined to give the correction for any regular defect of form. It is shown that in general effective powers are not simply additive, but under conditions described in the paper the error made in regarding them as additive becomes small. The conditions involve the order of the lenses and the position of every lens except the first of the train. It is always possible to satisfy these conditions in a system designed for use in the way described. With incorrect arrangements serious errors may be made.

A. Trichromatic Colorimeter with Spectral Primaries. W. D. Wright Trans. Opt. Soc. 1927-28, No. 5, pp. 225-242.

The paper describes a trichromatic colorimeter that has been specially designed to make an accurate re-determination of the locus of the spectral colours in the colour triangle for as many observers as possible. A spectrometer system is used in which two spectra are formed from the same source. From one of these, three portions to act as primaries are reflected back through a lower part of the dispersing system, so that the mixing of the three radiations is effected by neutralising the prismatic dispersion by which the colours were first separated. From the other spectrum the test colour and a desaturating colour are selected and mixed in a similar manner, and the composite beams are then brought into the two halves of a simple bipartite field. In the process of being mixed with the other colours, each spectral colour is filtered by its return passage through the dispersing system and the instrument thus becomes very effective in removing stray light. Another device has enabled the Maxwellian method of observing the field of view to be adopted without the introduction of rotating parts into the system. The intensities of the three primaries are controlled with photometer wedges.

Vapor-Pressure Chart for Paraffin Hydrocarbons. O. G. Wilson, Jr. Ind. Engg. Chem. Dec. 1928, pp. 1363-1366.

An empirical equation has been developed which gives the vapor pressures of the normal hydrocarbons in terms of the temperatures and of the boiling points. A monographic chart is given as a quick and easy solution of the equation.—M.E.H.

Specific Gravity of Glycerol. L. W. Bosart and A. O. Snoddy. Ind. Engg. Chem. Dec. 1928, pp. 1377-1379.

Density and Percentage tables covering the temperatures 15, 15.5, 20, 25 and 30 degrees C. are given, and comparisons made with values that appear in the International Critical Tables.—M.E.H.

CLOCKS. R. Graseby, London, Eng. Pat. No. 295,780.

RECORDING SPEED AND RUNNING PARTICULARS OF VEHICLES. J. Tisdale Vancouver, Canada. Pat. No. 295,794.

THERMOSTATIC VALVES. Radiation, Ltd., London, Eng. Pat. No. 295,823.

WEIGHING APPARATUS. Maatschappij tot Vervaardigung Van Snijmachines Volgens. Rotterdam, Holland. Pat. No. 295,853.

CLOCKS. U. Vuille, Berne, Switzerland. Pat. No. 295,868.

GALVANOMETERS. Electroflo Meters Co., London, Eng. Pat. No. 295,887.

THERMOMETERS. R. S. Whipple and Cambridge Instrument Co., London, Eng. Pat. No. 295,893.

RECORDING APPARATUS. H. R. Cool, Cleveland, Ohio. Pat. No. 295,981.

ELECTRIC CLOCKS. F. Conrad, Pittsburgh, Pa. Pat. No. 296,031.

SPEED INDICATORS. L. Irving, Leeds, Eng. Pat. No. 296,039.

MICROSCOPES. J. V. Ramsden, Shrewsburg, Eng. Pat. No. 296,042.

GAS METERS. Pintsch Akt., Ges, Berlin, Germany. Pat. No. 296,062.

WEIGHING APPARATUS. F. Mercken, Brussels, Belgium. Pat. No. 296,099.

THERMOSTATIC VALVES. K. Aird and Main, Ltd., London, Eng. Pat. No. 296,129.

ELECTRICALLY WOUND TIMEPIECES. English Clock & Watch Manufacturers, Coventry, Eng. Pat. No. 296,150.

MEASURING THE MOISTURE CONTENT OF WOOL. Royles, Ltd., Manchester, Eng. Pat. No. 296,157.

MASTER CLOCKS. T. and F. Mercer, Hertfordshire, England. Pat. No. 296,181.

PHOTOMETRY. J. Y. Johnson, London, England. Pat. No. 296,190.

WEIGHING APPARATUS. F. J. Troll, Towson Heights, Md. Pat. No. 296,227.

MAGNETIC TESTS. International General Electric Co., New York, N. Y. Pat. No. 296,303.

ELECTRIC METERS. Landis & Gyr, Zug. Switzerland. Pat. No. 296,368.

ELECTRIC REGULATORS. British Thomson-Houston Co., Ltd., London, England. Pat. No. 296,402.

TESTING HEARING. Siemens & Halske A. G. Siemensstadt-Berlin, Germany. Pat. No. 296,433.

DELIVERING MEASURED QUANTITIES OF LIQUIDS. J. Marshall, Ilford, England. Pat. No. 296,575.

ELECTRIC DISTANT CONTROL AND SIGNALLING SYSTEMS. Associated Telephone & Telegraph Co., Kansas City, Mo. Pat. No. 296,664.

WEIGHING APPARATUS. F. Garaventa & G. Tripodi, Genoa, Italy. Pat. No. 296,672.

COUNTING APPARATUS. Igranic Electric Co., London, England. Pat. No. 296,718.

TIMEPIECES. Fabriques Movado, La Chaux-de-Fonds, Switzerland. Pat. No. 296,721.

ELECTRIC MEASUREMENTS. J. W. Record, Cheshire, England. Pat. No. 296,749.

INDUCTION MOTOR METERS. Landis & Gyr, Zug, Switzerland. Pat. No. 296,771.

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FAULT FINDING AND PROTECTIVE ARRANGEMENTS FOR DYNAMO-ELECTRIC MACHINES. Ganz-Fele Villamossagi Reszventtarasag, Budapest, Hungary. Pat. No. 297,473.

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ELECTRIC REGULATING APPARATUS. R. Unzeitig, Vienna, Austria. Pat. No. 297,056.

A New Pycnometer for Solids: The Compressibility of Sodium, Barium and Beryllium. T. W. Richards, L. P. Hall, B. J. Mair. Jl. Amer. Chem. Soc. Dec. 1928, pp. 3304-3310.

Diagram and description are given.—M.E.H.

A Temperature Regulator for Carius Furnaces. G. B. Heisig. Jl. Amer. Chem. Soc. Dec. 1928, pp. 3388.

It is suggested that gas-fired Carius furnaces be equipped with a thermostat of the type used to control the temperature of ovens on gas cooking stoves. Range 100-325 degrees.—M.E.H.

Ignition of Mixtures of Air with Natural Gas and with Methane by Induction Coil Sparks. E. G. Meiter. Ind. Engg. Chem. Dec. 1928, pp. 1353-1354.

The apparatus and method of experimentation were similar to those described by Sastry and Wheeler. The measure of ignitibility of a given mixture was the amount of current that had to be broken in the primary circuit of the coil to give a discharge just capable of igniting the mixture.—M.E.H.

A Vacuum Tube Potentiometer for Rapid E. M. F. Measurements. H. M. Partridge. Jl. Amer. Chem. Soc. Jan. 1929, pp. 1-7.

A device is described which employs a tetrode and a triode in a simple potentiometer circuit and arranged in such a manner that calibration of the valves and the constancy of their characteristics are unnecessary.—M.E.H.

The Electrometric Titration of Manganese by the Volhard Method. B. F. Brann and M. H. Clapp. Jl. Amer. Chem. Soc. Jan. 1929, pp. 39-41.

A modification of the "dead stop end-point" method of electrometric titration is described, and it is shown that this method may be applied satisfactorily in the Volhard titration of Mn.—M.E.H.

A Bacteriological Conductivity Culture and Some of Its Applications. L. B. Parsons, E. T. Drake and W. S. Sturges. Jl. Amer. Chem. Soc. Jan. 1929, pp. 166-171.

A new method of studying biochemical activities of certain organisms involving a combined culture conductivity cell is described.—M.E.H.

A Simple Apparatus for the Determination of Carbon Dioxide. R. C. Wiley. Jl. Amer. Chem. Soc. Jan. 1929, pp. 222.

Made up from ordinary laboratory material, this simple apparatus claims to reduce to a minimum the possibilities of air-CO_2 contamination. Diagram is given.—M.E.H.

Boiling Points of Electrolytic Caustic Solutions. C. C. Monrad and W. L. Badger. Ind Engg. Chem. Jan. 1929, pp. 40-42.

Apparatus for the determination of boiling points of caustic solutions is described. The apparatus is mostly of metal.—M.E.H.

The System Ferrous Oxide-Silica. C. H. Herty and G. R. Fitterer. Ind. Chem. Jan. 1929, pp. 51-57.

The methods used in the preparation of the ferrous silicates, the microanalyses, and the determinations of melting points are different from those used in any previous investigation on this system.—M.E.H.

The Detergent Action of Soap. F. H. Rhodes and S. W. Brainard. Ind. Engg. Chem. Jan. 1929, pp. 60-68.

A satisfactory method for the quantitative determination of detergent power is described.—M.E.H.

Thermoelectric Measurement of Temperatures above 1500° C. H. L. Watson and H. Abrams. Paper delivered before the Amer. Electrochemical Soc. Sept. 1928.

After a brief discussion of the standard methods of temperature measurements from 1,000 to 2,000° C. (1,832 to 3,632° F.) an account is given of a tungsten graphic thermocouple, including its construction, characteristics and application. This couple has been used, with suitable protection, to over 1,700° C. (3,092° F.) in oxidiing atmospheres. Repeated runs to 1,850° C. (3,362° F.) have been made in the vacuum furnace, as well as short runs to about 2,400° C. (4,352° F.) at atmospheric pressure in reducing atmospheres. The elements when properly selected and treated are interchangeable within 5 per cent. Abstracted in Fuels & Furnaces, Dec. 1928, pp. 1741-1742.

Physical Properties of Dental Materials. R. L. Coleman. B. of S. Jl. of Res. Dec. 1928, pp. 867-938.

Practical methods of testing these materials were developed, and these methods and the apparatus used are described.

Use of the Under-Water Spark with the Hilger Sector Photometer in Ultra-Violet Spectrophotometry. H. J. McNicholas. B. of S. Jl. of Res., Dec. 1928, pp. 939-949.

The paper describes a device for the operation of a high-voltage electric discharge between metal terminals under distilled water and its use with the Hilger sector photometer in ultra-violet spectrophotometry.

The spark terminals are enclosed in a hard-rubber box, through which a stream of distilled water may be circulated. External adjustments are provided for the length of the spark gap and its position relative to the axis of the optical system.

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REGISTRIERVORRICHTUNG. Soc. Anon. Ed. Jaeger, Paris, France. Pat. No. 463,008.

VORRICHTUNG ZUM ANZEIGEN DES VERHAELTNISSES DES KRAFTSTOFFVERBRAUCHES VON FAHRZEUGEN. Siemens & Halske, Berlin, Germany. Pat. No. 463,097.

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STATIVKOFF MIT KUGELGELENK. F. Martmann, Vienna, Austria. Pat. No. 463,438.

A Sensitive Vacuum Tube Voltmeter. C. B. Aiken. Jl. Opt. Soc. Dec. 1928, pp. 440-450.

There is described a new type of vacuum voltmeter which makes use of the heterodyne principle. The use of this meter is restricted to the measurements of steady, single frequency voltages in the audio and lower radio frequency range.

The meter has a linear characteristic and is extremely sensitive, the model described having a sensitivity of four scale divisions per millivolt. A sensitivity three times as large as this has been obtained by employing a different type of galvanometer and it is probable that by using the best type of galvanometer available this could be increased to the order of one division per microvolt.

Measurements may be made of weak signals which are accompanied by a relatively strong noise background.

A Simple Tread Cracking Test. A. H. Nellen. Rubber Age. Jan. 10, 1929, pp. 373-374.

This article describes a device used by the Lee Tire and Rubber Company in testing cracking resistance of tire treads.—M.B.R.

Austenite Decomposition and Length Changes in Steel. E. Bain and W. Waring. Trans. A.S.S.T. Jan. 1929, pp. 69-95.

The equipment for recording length changes of a number of steel cylinders occurring during quenching at various rates, is described with suggestions for its improvement.—M.B.R.

Determination of Hydrogen-Ion Concentration of Flour-water Mixtures. P. Halton and E. A. Fisher. Cereal Chemistry. Nov. 1928, pp. 445-460.

Two methods for the determination of hydrogen-ion concentration of flour-water mixtures, viz., the colorimetric and the electrometric, are taken up. With the latter method both hydrogen and quinhydrone electrodes have been used.—M.B.R.

Note on the Gasometric Determination of Carbon dioxide by the Chittick Method. R. Hertwig and J. Hicks Cereal Chemistry. Nov. 1928, pp. 481-484.

Method briefly discussed and results given.—M.B.R.

Magnetic Analysis. R. Sanford. Jl. A.I.E.E. Jan. 1929, pp. 7-9.

This paper presents a brief outline of the development and application of magnetic analysis for the nondestructive testing of iron and steel and their products. The subject is treated under the following headings: Historical development, Experimental results, Practical commercial applications and conclusion.—M.B.R.

Stellar Radiation Measurements. E. Pettit and S. Nicholson Astrophysical Jl. Nov. 1928, pp. 279-308.

This paper discusses measurements of stellar radiation made during the period 1922 to 1927 with vacuum thermocouples attached to the 100 inch telescope. Twelve different thermocouples in cells provided with windows of rock salt, fluorite, quartz and microscope cover glass are employed. —M.B.R.

The Selenium Cell: Its properties and Application. G. Barnard. Jl. Inst. Elect. Engrs. Dec. 1928, pp. 97-120.

The paper deals with the early history of research on selenium, and its sensitivity to light. The properties of selenium cells are dealt with, as well as the chemical, electrolytic and electronic theories of the action of light on selenium. Very extensive referencees are given.—M.B.R.

Improved Laboratory Rectifying Column. Melville J. Marshall. Ind. Engg. Chem. Dec. 1928, p. 1379.

It is possible with this column to adjust the reflux ratio accurately and rapidly at any value up to total reflux.—M.E.H.

Simple Accelerated Exposure Test for Varnishes and Lacquers. Hugo V. Hansen. Ind. Engg. Chem. Dec. 1928, pp. 1384-5.

It is thought that the method might be of interest to those who desire a simple test which will give indication more rapidly than outdoor exposure. Apparatus is described.—M.E.H.

Recommended Equipment of a Modern X-Ray Laboratory for the Study of Structures of Materials. George L. Clark. Ind. Engg. Chem. Dec. 1928, pp. 1386-1390.

A detailed description is given of the various types of complete X-ray apparatus such as may be employed advantageously in the study of fine structures of materials by the diffraction method. —M.E.H.

Apparatus for Micro Gas Analysis. C. H. Prescott, Jr. Jl. Amer. Chem. Soc. Dec. 1928, pp. 3236-3240.

The apparatus was designed to operate on samples whose volumes would be a third of a cubic centimeter or less at one atmosphere, and to determine CO_2, CO, H_2 and N_2. A diagram is shown.—M.E.H.

Recording Instruments in Cost Analysis. H. Nock and H. Edgerly. G. E. Rev. Dec. 1928, pp. 644-647.

The importance of recording instruments for cost analysis is briefly considered.

Flame and Pressure Propagation. J. V. Hunn and George G. Brown. Ind. Engg. Chem., Oct. 1928, pp. 1032-1040.

Apparatus and method of operation are described in detail for studying the relation between flame propagation and the pressure changes resulting therefrom.—M.E.H.

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Instruments Book Shelf

Orders for copies of the books reviewed in this section can be sent to Instruments Book Shelf, care of Instruments Publishing Company, 1117 Wolfendale Street, Pittsburgh, Pa.

NAVIGATIONAL WIRELESS. *S. H. Long.* Chapman & Hall, Ltd., 1927. Cloth 6 by 9, 164 pages, 162 figs.

REVIEWED BY D. L. MATHIAS

The author attempts to fill a long felt want for a book dealing with direction finding by means of a single loop or frame aerial. He discusses the question of whether a direction finder should be worked by a wireless operator or by a navigator. The object of this book is to link up these two branches so that each has a good working knowledge of what the other is doing. The general electrical principles are very simple, and only that is included which is considered indispensable to procure a working knowledge of direction finding installations. The navigational portion, although very elementary to the navigator, will be useful to the wireless telegraph operator, because it will assist him to understand how bearings are applied in the navigation of ships. Moreover, as it is highly probable that in the future the working of direction finding installations will be an essential portion of the training of navigators, this book will be found useful to mariners wishing to familiarize themselves with the problems involved in the use of single-frame direction finding in marine work.

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INSTRUMENT PIONEERS—JOSEPH WILLARD LEGG (1889-1929).

INSTRUMENTS, Vol. 2, No. 2, February 1929, pp. 51-52, 1 fig.

A brief history.

THE OSTWALD COLOR THEORY.

DR. ALBERT PARSONS SACHS, INSTRUMENTS, Vol. 2, No. 2, February 1929, pp. 53-55.

This article is the introduction to a series on this subject. A classification of colors is given.

RECENT DEVELOPMENTS IN THE FIELD OF MAGNETIC MEASUREMENTS.

THOMAS SPOONER, INSTRUMENTS, Vol. 2, No. 2, February 1929, pp. 57-63, 7 figs.

Continued from January issue. This installment considers: Magnetic Analysis and Magnetic surveying.

Under Magnetic Analysis is considered: 1. Magnetic Inspection of Turbine Bucket Wheels; 2. DeForest's Methods; 3. Ball-Bearing Race Tests; 4. Hardness Testing of Steel Balls; 5. Incremental Permeability Tests; 6. Sperry's Rail Tester; 7. The Duroscope.

Under Magnetic Surveying, Rieber's new device is described.

SPECIFIC GRAVITY AND VISCOSITY OF VARNISHES, PAINTS, ETC.

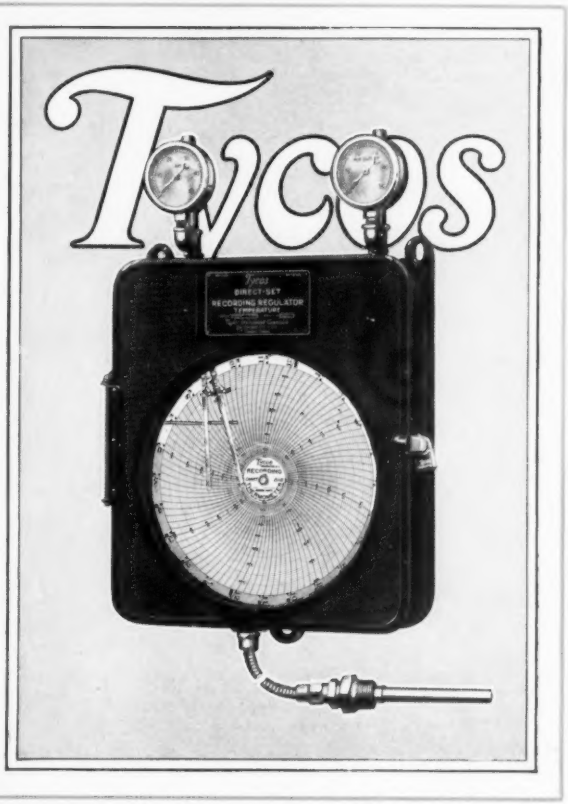
H. L. HAZELTINE, INSTRUMENTS, Vol. 2, No. 2, February 1929, pp. 65-68, 1 fig.

Continued from December 1928 issue. The measurement of viscosity with the Stormer and MacMichael viscosimeters is discussed.

SEARCHING FOR INFORMATION ON INSTRUMENTS AND MEASUREMENTS.

RICHARD RIMBACH and M. BERG RIMBACH, INSTRUMENTS, Vol. 2, No. 2, February 1929, pp. 69-70.

Continued from January issue. This installment gives suggestions for searching out patent information and when locating sources of supply of special instruments and devices for measurement inspection and control.



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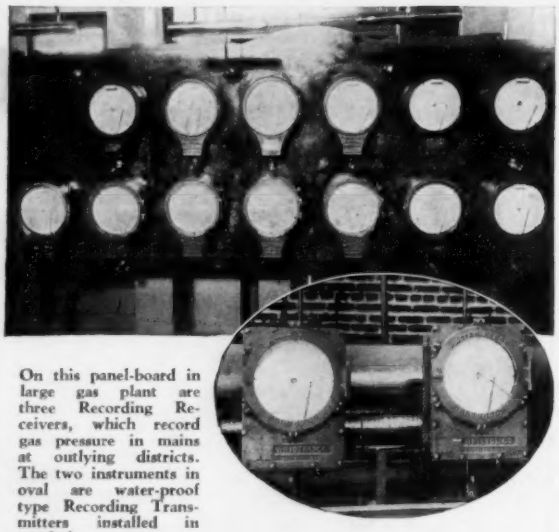

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